EMPIRICAL STUDY ON THE PERCEPTIONS OF CUSTOMERS ON RETAIL BANKING SERVICES IN COMMERCIAL BANKS OF ANDHRA PRADESH

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Abstract:
Retail banking in India has emerged as one of the key drivers of the overall banking industry and has witnessed enormous growth in the recent past. The Retail Banking concept is not new to banks but is now turned as an important and attractive market segment that offers opportunities for growth and development. All the needs of individual customers are taken care of in a well – integrated manner in retail banking. Retail banking is being considered as one of the most innovative financial services provided by the various commercial Public Sector Banks (PSBs), private sector and foreign banks in today's competitive environment. Retail banking has a huge potential considering the growing demand for its products viz., term deposits, consumer durable loans, auto loans, debit card, credit cards, ATM facilities, online banking, etc. Increasing competition in the banking industry is forcing banks to pay much more attention towards satisfying customers by providing wide variety of quality products/services. As the level of awareness to customers increases, it leads to increase in customer preferences. Expectations of the customers for more services by the banks are increasing day by day and this has compelled banks to innovate and offer variety of products/ services.

Key words: Retail Banking; Public sector banks; ATM facilities; Consumer durable loans; and online banking;

INTRODUCTION:
Banking is a customer oriented competitive industry (e.g. Lee and Moghavvemi, 2015; Vencataya et. al., 2019; Benţe, 2018). Any successful bank bases its product and service orientation on consumer needs. In order to survive in a cutthroat industry where client needs are constantly changing, banks must create cutting-edge products and services.

Consumer banking or personal banking or Retail banking, provide services to the general public, rather than to companies, corporations or other banks, which are often described as wholesale banking or corporate banking.

Retail banking or personal banking runs on a phrase called 'Banking at your doorsteps' which helps to give innovative products and services to customers and thus helps the banks to improve their financial position in the market. Retail banking is significantly growing in the Indian Commercial Banking sector in recent years. Excess of liquidity, more dependence of corporates on capital markets, the rising income of people with increase in purchasing power and the ability to handle debts, the increasing amount of Non Performing Assets (NPAs) from corporate sector and the future growth

potentials of the credit card business has induced banks to shift to Retail Banking operations.

In the recent era, the technological innovations have changed the entire face of the retail banking services and it has become an opportunity to differentiate mature market. These technologies are user friendly to the customers without bank employee's assistance. Now a day, banking automation service is indispensable in order to obtain efficiency to provide basic financial needs.

Retail Banking Services:

Standard retail banking products/services include the following:

Savings Account

Offered by most banking financial institutions, a Savings Bank Account lets a person to deposit cash in a brick-and-mortar bank branch or an ATM deposit machine known as CDM. The funds in the Savings Account can be used for the expenses like money transfers, bill payments, etc. Bank provides nominal interests on Savings Account deposits. Customer can access funds in his Savings Account through internet or mobile banking platforms.

Current Account

It is a retail banking product designed for businesses which typically need to conduct daily transactions. For example a shop owner may want to deposit daily earnings and withdraw large sums to manage transactions. A customer of Current account enjoys the financial services like deposits and withdrawals any no. of times, pay-orders, cheques, overdraft facilities etc., to keep their businesses afloat.

Term Deposits

The retail banking products also includes term deposits. With competitive interest rates Banks offer fixed deposits and recurring deposits. One can easily open a term deposit as a retail banking customer as most banks offer this facility.

Loans

One of the most widely availed retail banking products is Loans. Banks offer variety of loans as per the requirement of the customers, including Personal Loans, Home Loans, Education Loans, Gold loans, etc. On the principal amount sanctioned by the banks interest be levied. The maximum loan amount can get by the customer and repayment tenure depends on the type of loan chosen by him/her.

Bank Cards

All banks offer debit/credit card services to their retail customers. Debit cards enable the customer to access funds in his/her account anytime. The customer can use his/her debit/credit card to shop online, pay bills, and withdraw cash from Automated Teller Machines (ATMs), but on credit card extra charges may be levied.

Banks offers everyday banking services to their retail customers. Customers need the most basic retail banking products, like a bank account, to access other types of retail banking products and services. Achieving customer satisfaction and loyalty is very much required for long term survival of any bank. Customer service is defined as the capability of any organization to constantly and consistently mould as per the customers' requirements. Satisfaction is influenced by banking product features, service fees, communication methods, and, to a smaller degree, customer convenience (Pareek, 2014). Increasing competition in the banking industry is forcing banks to pay much more attention towards satisfying customers by providing wide variety of quality products/services. With the help of modern technology customers are updating their knowledge on developments in the economic environment, which includes the financial system. In this dynamic environment, financial requirements of the customers are taking new forms like quick cash accessibility, money transfer, asset security, increased return on surplus funds, financial advice, deferred payments etc. As the level of awareness increases,

it leads to increase in customer preferences. Expectations of the customers for more services by the banks are increasing day by day and this has compelled banks to innovate and offer variety of products/ services.

NEED FOR THE STUDY:
From the historical background of traditional system on cash transaction, there are many developments has undertaken in the banking activities. In olden days, there was a concept of barter system, now in the concept of E-banking, E-commerce; M- banking lot of technological improvements has been under taken in the banking sector. In the olden days, to with draw or to deposit money in the bank, there was more crowed and also time consuming. But today the cash transaction is taking place with in no time. These kinds of activities are undertaken through the concept of retail banking system. Retail banking provides more number of services in the banking activities according to the needs of the customer, and some services changed the interface of banking industry. Therefore there is a need to focus on perceptions of customers on retail banking services for betterment of the services and designing of new services.

OBJECTIVES OF THE STUDY:
1. To know and study about the products/services offered by the commercial banks under retail banking.
2. To study the perception of customers of SBI and HDFC banks on select retail banking services.
3. To offer suggestions basing on the analysis of the data.

LITERATURE REVIEW:
Schumpeter (1961) said that due to the rapid innovations in the banking sector there is more scope has been given to satisfy the customer's needs through various products of retail banking and also focuses on the role of bank credit influence the development of economy and it is one of the opportunities to innovate financed bank credit.

Gopinath (2005) explains the salient features of retail banking and points out that retail banking should include, in its purview, not only the lending or asset side, but also the deposit mobilisation or liability side of banking activity.

K. Suma Vally and K. HemaDivya (2018) in the Paper "A study on digital payments in India with perspective of consumers Adoption" conclude that the deployment of technology for digital payments have improved the performance of banking sector and able to achieve the motive cash less country. This study also gives emphasis to the percentage of awareness on maximum utilization of technology. Banks should take effective measure in creating awareness towards the effective usage technology and security.

Dave et al., (2020) said that Customers have started preferring paying through debit cards especially after demonetization. Debit cards have various other facilities—it can be used to withdraw cash from an ATM, purchase of goods and services at point of sale, and make payments for e-commerce online transactions, both inland and foreign. In this paper, the authors investigated the customer preference over the different payment options, the factors affecting debit card usage, the frequency, the charges and the reason for using debit cards post demonetization.

K. Harichandana and Md.Sohail Baba (2020) said that banks play an important role in the economic development of any country in the world by the way of providing loans to meet the needs of the people directly and indirectly support industrial development. Loans and advances are the major part of the funds used by the banks. This paper concluded that any debt is an important task of the bank and traders, companies avail loans and provide financial assistance to individuals and industries.

RESEARCH METHODOLOGY:
The present study is based on bothPrimary and Secondary data sources of information. The secondary

sources are used for the purpose of understanding the concept, importance of retail banking products/services from the standard text books, journals and other internet sources.

The primary sources of information for the study are collected by using structured schedule for customers. This schedule is pre-tested for the main study.

DISCUSSIONS OF THE STUDY:
1) CARD-BASED SERVICES:

A bank issues plastic cards i.e., debit and credit cards, for providing various card- based services ranging from cash withdrawal to swift transfer as against certain charges. India is the 13th largest non-cash payment market globally[1]. Data is collected from the respondents regarding their opinion or feeling with respect to card-based services with the select banks and six attributes have been identified to understand their perspectives which are presented in the table 1 here under.

Table 1: Customers' Perceptions On Card-Based Services Of Banks

S.No.	Statement	Bank	ScaleValue	Mean	SD	Highest Scale Value
1	Acquiring debit/credit card of this bank is easy	SBI	1633	4.08	0.71	SBI
		HDFC	1621	4.05	0.70	
2	Card issue charges are low	SBI	1571	3.93	0.78	HDFC
		HDFC	1635	4.09	0.75	
3	Bank charges are transparent	SBI	1639	4.10	0.56	SBI
		HDFC	1635	4.09	0.62	
4	Low Interest on delayed payments	SBI	1652	4.13	0.65	HDFC
		HDFC	1661	4.15	0.59	
5	Card annual maintenance charges are low	SBI	1464	3.66	0.83	HDFC
		HDFC	1496	3.74	0.89	
6	Staff provides timely information regarding charges/ fees, terms & conditions	SBI	1605	4.01	0.7	HDFC
		HDFC	1646	4.12	0.63	
Total score	SBI		**9564**			
	HDFC		**9694**			

Source: Primary Data

Note:

Maximum Possible Score	5 (Maximum score points) X 400 (number of respondents) X 6 (number of statements)		12000	
Percentage of score	SBI	The total score / Maximum Possible Score X 100	79.70	HDFC
Percentage of score	HDFC	The total score / Maximum Possible Score X 100	80.78	

Upon enquiry it is understood that the respondents' opinions on the variable 'Acquiring debit/credit card of this bank is easy' was tabulated. The mean and SD values of SBI are 4.08 and 4.05 whereas for HDFC mean and SD values are 0.71 and 0.70. By comparing the score values, SBI has more customer satisfaction for the attribute 'Acquiring debit/credit card of this bank is easy'.

The respondents' opinion on the variable 'Card issue charges are low' was analysed. The mean and SD values for SBI are 3.93 and 0.78, whereas mean and SD values for HDFC are 4.09 and 0.75respectively. By comparing the score values, HDFC bank has more customer satisfaction for the attribute 'Card issue charges are low'.

Upon enquiry it is understood that the respondents' opinions on the statement 'Bank charges are transparent' was analysed and tabulated. The mean and SD values for SBI is 4.10 and 0.56, whereas in case of HDFC mean and SD values are 4.09 and 0.62 respectively. By comparing the score values, SBI has more customer satisfaction for the attribute 'Bank charges are transparent'.

The respondents' opinion on the attribute 'Low Interest on delayed payments' was taken and analysed. The mean and SD values for SBI is 4.13 and 0.65respectively, whereas in case of HDFC the mean and SD values are 4.15 and 0.59 respectively. By comparing the score values, HDFC bank has more customer satisfaction for the attribute 'Low Interest on delayed payments'.

Upon enquiry it is understood that the respondents' opinion on the attribute 'Card annual maintenance charges are low' was tabulated and analysed. The mean and SD values for SBI is 3.66 and 0.83. While in case of HDFC, mean and SD values are 3.740 and 0.89 respectively. By comparing the score values, HDFC bank has more customer satisfaction on the attribute 'Card annual maintenance charges are low'.

The respondents' opinions on the attribute 'Staff provides timely information regarding charges/ fees, terms & conditions' was calculated. The mean and SD values for SBI is 4.01 and 0.70 where in case of HDFC mean and SD values are 4.12, and 0.63 respectively. By comparing the score values, SBI has more customer satisfaction on the variable 'Staff provides timely information regarding charges/ fees, terms & conditions'.

As per the scale value analysis, the data clearly indicates that for the statement card-based services with respect to select banks, majority of the customers are satisfied with the HDFC bank.

2) MOBILE/INTERNET BANKING/UPI SERVICES:

Technology has brought rapid changes in banking sector along with other sectors. IT brought all the financial products/services to the door step of the customers through Mobile/Internet/UPI services. Data is collected from the respondents regarding their opinion or feeling on various activities related to Mobile/Internet Banking/UPI services provided by the select banks and six attributes have been identified to understand their perspectives which are presented in the table 2 here under.

Table 2: Customers' Perceptions On The Mobile/Internet Bankin5g/ Upi Services

S.No.	Statement	Bank	ScaleValue	Mean	SD	Highest Scale Value
1	Quick accessibility to services	SBI	1576	3.94	0.7	SBI
		HDFC	1565	3.91	0.79	
2	No transaction limit	SBI	1631	4.08	0.65	SBI
		HDFC	1572	3.93	0.75	
3	Will Receive SMS/ Electronic alert for each transaction	SBI	1622	4.06	0.65	SBI
		HDFC	1590	3.98	0.62	
4	Quick resolving of queries	SBI	1646	4.12	0.58	EQUAL
		HDFC	1646	4.12	0.57	
5	Low service charges	SBI	1654	4.14	0.64	SBI
		HDFC	1609	4.02	0.63	
6	Speedy customer services	SBI	1656	4.14	0.58	SBI
		HDFC	1639	4.1	0.55	
Total score		SBI	**9785**			
		HDFC	**9621**			

Source: Primary Data

Note:

Maximum Possible Score	5 (Maximum score points) X 400 (number of respondents) X 6 (number of statements)		12000	
Percentage of score	SBI	The total score / Maximum Possible Score X 100	81.54	SBI
Percentage of score	HDFC	The total score / Maximum Possible Score X 100	80.18	

Upon enquiry it is understood that the respondents' opinions on the variable 'Quick accessibility to services' was tabulated. The mean and SD values for SBI is 3.94 and 0.70 whereas for HDFC, bank values are 3.91 and 0.79. By comparing the score values, SBI has more customer satisfaction on the variable 'Quick accessibility to services'.

The respondents' opinion on the variable 'No transaction limit' was calculated. The mean and SD values for SBI is 4.08 and 0.65, whereas for HDFC bank, values are 3.93 and 0.75 respectively. By comparing the score values, SBI has more customer satisfaction on the variable 'No transaction limit'.

Upon enquiry it is understood that the respondents' opinion on the attribute 'Will Receive SMS/ Electronic alert for each transaction' was computed. The mean and SD values for SBI is 4.06 and 0.65, whereas for HDFC bank, values are 3.98 and 0.62 respectively. By comparing the score values,

SBI has more customer satisfaction on the variable 'Will Receive SMS/ Electronic alert for each transaction'.

The respondents' opinion on the variable 'Quick resolving of queries' was calculated. The mean and SD values for SBI is 4.12 and 0.58, whereas for HDFC bank, values are 4.12 and 0.57. By comparing the score values, SBI & HDFC banks both are equal customer satisfaction on the variable 'Quick resolving of queries'.

Upon enquiry it is understood that the respondents' opinion on the attribute 'Low service charges' was calculated. The mean and SD values for SBI is 4.14 and 0.64, whereas for HDFC bank, values are 4.02 and 0.63 respectively. By comparing the score values, SBI has more customer satisfaction on the variable 'Low service charges'.

The respondents' opinion on the attribute 'Speedy customer services' was calculated. The mean and SD values for SBI is 4.14 and 0.58, whereas for HDFC bank, values are 4.10 and 0.55. By comparing the score values, SBI has more customer satisfaction on the variable 'Speedy customer service'.

As per the scale value analysis, the data clearly indicates that mobile/internet/UPI services are an essential product / service of the bank. Majority of the customers are satisfied with the SBI in this regard.

3) AUTO PAYMENT SERVICES:

One of the best services provided by the banks with improved technology is automated bill payment services, which facilitate the customer to pay all types of bills through online banking with standing instructions. Data is collected from the respondents regarding their opinion or perception on different variables like 'enabling/disabling of service is easy', 'quick access for payment', etc., while using the auto payment services by the select banks, five attributes have been identified to understand their perspectives and is presented in the table 3 here under.

Table 3: Customers' Perceptions On Auto Payment Services

S.No.	Statement	Bank	ScaleValue	Mean	SD	Highest Score Value
1	Enable/ Disable of service is easy	SBI	1615	4.04	0.71	SBI
		HDFC	1587	3.97	0.61	
2	Quick payment access	SBI	1655	4.14	0.64	SBI
		HDFC	1595	3.99	0.68	
3	Will receive SMS/ Electronic alert before and after	SBI	1606	4.02	0.75	SBI
		HDFC	1556	3.89	0.79	
4	High default payment charges	SBI	1624	4.06	0.67	SBI
		HDFC	1599	4.00	0.67	
5	Good responsiveness of help desk	SBI	1672	4.18	0.57	SBI
		HDFC	1620	4.05	0.64	
Total score		SBI	**8172**			
		HDFC	**7957**			

Source: Primary Data.

Note:

Maximum Possible Score	5 (Maximum score points) X 400 (number of respondents) X 5 (number of statements)		10000	
Percentage of score	SBI	The total score / Maximum Possible Score X 100	81.72	SBI
Percentage of score	HDFC	The total score / Maximum Possible Score X 100	79.57	

Upon enquiry it is understood that the respondents' opinion on the variable "Enable/ Disable of service is easy" was tabulated. The mean and SD values for SBI is 4.04 and 0.713 whereas for HDFC, mean and SD values are 3.97 and 0.61. By comparing the score values, SBI has more customer satisfaction for the attribute "Enable/ Disable of service are easy".

The respondents' opinion on the variable 'Quick payment access' was calculated. The mean and SD values for SBI is 4.14 and 0.64, whereas in case of HDFC, mean and SD values are3.99 and 0.68. By comparing the score values, SBI has more customer satisfaction on the attribute 'Quick payment access'.

Upon enquiry it is understood that the respondents' opinion on the variable 'Will receive SMS/ Electronic alert before and after' was computed. The mean and SD values for SBI is 4.02 and 0.75. While in case of HDFC, mean and SD values are 3.89 and 0.79. By comparing the score values SBI has more customer satisfaction for the attribute 'Will receive SMS/ Electronic alert before and after'. The respondents' opinion on the variable 'High default payment charges' was calculated. The mean and SD values for SBI are 4.06 and 0.67. While in case of HDFC, mean and SD values are 4.00 and 0.67. By comparing the score values, SBI has more customer satisfaction on the variable 'High default payment charges'.

Upon enquiry it is understood that the respondents' opinion on the variable 'Good responsiveness of help desk' was calculated. The mean and SD values for SBI is 4.18 and 0.57, whereas in case of HDFC bank, mean and SD values are 4.05 and 0.64. By comparing the score values, SBI has more customer satisfaction on the attribute 'Good responsiveness of help desk'.

As per the scale value analysis, the data clearly indicates the auto payment services are an essential product / service of the bank. Majority of the customers are satisfied with the SBI.

4) AVAILING LOAN:

One of the basic functions of a bank is granting loans. While granting loans banks have to follow some process and formalities. Data is collected from the respondents regarding their opinion or perceptions on various variables related to availing loan from the banks like getting appropriate information from the staff, time taken for approval of loan…etc., by the select banks. Thus, five attributes has been identified to understand their perspectives and is presented in the table 4 here under.

Table 4: Customers' Perceptions On Availing Loan From The Banks

S.No	Statement	BANK	Scale Value	Mean	SD	Highest Score Value
1	Staff are providing adequate information regarding the loan	SBI	1530	3.83	0.85	SBI
		HDFC	1525	3.81	0.78	
2	Eligibility norms are simple / easy to understand	SBI	1625	4.06	0.64	SBI
		HDFC	1617	4.04	0.65	
3	Loan application process is simple & easy	SBI	1603	4.01	0.64	SBI
		HDFC	1598	4.00	0.71	
4	Loan approval time is less /fast	SBI	1610	4.03	0.66	SBI
		HDFC	1599	4.00	0.77	
5	Staff are helpful in resolving post disbursement issues	SBI	1612	4.03	0.62	SBI
		HDFC	1586	3.97	0.72	
Total score		SBI	**7980**			
		HDFC	**7925**			

Source: Primary Data

Note:

Maximum Possible Score	5 (Maximum score points) X 400 (number of respondents) X 5 (number of statements)		10000	
Percentage of score	SBI	The total score / Maximum Possible Score X 100	79.80	SBI
Percentage of score	HDFC	The total score / Maximum Possible Score X 100	79.25	

Upon enquiry it is understood that the respondents' opinion on the variable 'Staff are providing adequate information regarding the loan' was tabulated. The mean and SD values for SBI is 3.83 and 0.85 whereas for HDFC bank values are 3.81 and 0.78. By comparing the score values, SBI has more customer satisfaction for the attribute 'Staff are providing adequate information regarding the loan'. The respondents' opinion on the variable 'Eligibility norms are simple / easy to understand' was calculated. The mean and SD values for SBI is 4.06 and 0.64, whereas for HDFC bank values are 4.04 and 0.65. By comparing the score values, SBI has more customer satisfaction on the variable 'Eligibility norms are simple / easy to understand'.

Upon enquiry it is understood that the respondents' opinion on the attribute 'Loan application process is simple & easy' was computed. The mean and SD values for SBI is 4.01 and 0.64, whereas for HDFC bank values are 4.00 and 0.71. By comparing the score values, SBI has more customer satisfaction for the attribute 'Loan application process is simple & easy'.

The respondents' opinion on the variable 'Loan approval time is less /fast' was calculated. The mean and SD values for SBI is 4.03 and 0.66, whereas for HDFC bank values are 4.00 and 0.77. By comparing the score values, SBI has more customer satisfaction for the attribute 'Loan approval time is less /fast'.

Upon enquiry it is understood that the respondents' opinion on the variable 'Staff are helpful in resolving post disbursement issues' was calculated. The mean and SD values for SBI is 4.03 and 0.62, whereas for HDFC bank values are 3.97 and 0.72. By comparing the score values, SBI has more customer satisfaction on the variable 'Staff is helpful in resolving post disbursement issues'.

As per the scale value analysis, the data clearly indicates the availing loan from the bank services is one of the most prominent services of the bank and majority of the customers are satisfied with SBI.

FINDINGS:

Customers' perception on '**card-based services**' on various attributes such as – 'Acquiring a debit/credit card from this bank is easy', 'Card issue charges are low', 'Bank charges are transparent', 'Low Interest on delayed payments', 'Card annual maintenance charges are low', and 'Staff provides timely information regarding charges/fees, terms & conditions' are analysed statistically. The findings based on the Total Scale values are presented hereunder:

By comparing the score values, *SBI customers are more satisfied than* HDFC bank customers in case of 'acquiring a debit/credit card from the bank is easy' (SBI 1633, HDFC 1621), 'Bank charges are transparent' (SBI 1639, HDFC 1635), and 'Staff provides timely information regarding charges/ fees, terms & conditions' (SBI 1646, HDFC 1605). But in case of 'Card issue charges' (HDFC 1635, SBI 1571), 'low interest on delayed payments' (HDFC 1661, SBI 1652) and 'annual maintenance charges on card are less' (HDFC 1496, SBI 1464) *HDFC bank customers have more customer satisfaction* than the SBI. In case of card based services, on the two attributes – 'acquiring of card is easy' and 'bank charges are transparent' customers' satisfaction level is high with the public sector bank i.e. SBI. In the remaining four attributes HDFC bank has taken the lead. To increase the positivity in customers' perceptions SBI need to focus on the attributes of 'card based services'.

Customers' perception on '**The Mobile / Internet Banking / UPI services'** on various attributes such as – 'Quick accessibility to services', 'No transaction limits', 'Will Receive SMS/ Electronic alert for each transaction', 'Quick resolving of queries', 'Low service charges', and 'Speedy customer services' are analysed statistically. The findings based on the Total Scale values are presented hereunder:

By comparing the score values, *SBI customers have more customer satisfaction* than HDFC bank customers on the attributes 'Quick accessibility to services' (SBI 1576, HDFC 1565), **'**no transaction limits' (SBI 1631, HDFC 1572), 'Will Receive SMS/ Electronic alert for each transaction' (SBI 1622, HDFC 1590), **'**Low service charges' (SBI 1654, HDFC 1609) and 'speedy customer services' (SBI 1656, HDFC 1639). But in case of 'query resolving time' both banks are sharing equal score (1646). Under the digital India program the GOI is encouraging the digital transactions like mobile / Internet Banking / UPI services. In this process both banks are facilitating the mobile application, offering internet banking services and connected with UPI services. SBI is higher than HDFC bank. So the HDFC bank is advised to take necessary measures to improve service delivery efficiency through digitalization and thus enhance the confidence of customers.

Customers' perception on **'Auto payment services'** on various attributes such as – 'Enable/ Disable of service is easy', 'Quick payment access', 'Will receive SMS/ Electronic alert before and after', 'High default payment charges', and 'Good responsiveness of help desk' are analysed statistically. The findings based on the Total Scale values are presented hereunder:

By comparing the score values, *SBI customers have more customer satisfaction* than HDFC bank customers in all the attributes related with auto payment services. On auto payment services private sector bank HDFC need to be flexible in various attributes to improve the customer satisfaction.

Customers' perception on '**Availing loan from the bank'** on various attributes such as – 'Staff is providing adequate information regarding the loan', 'Eligibility norms are simple/easy to understand', 'The loan application process is simple & easy', 'Loan approval time is less /fast', and 'Staff is helpful in resolving post disbursement issues' are analysed statistically. The findings based on the Total Scale values are presented hereunder:

By comparing the score values, it is clear that *SBI taken a lead than HDFC* bank in all the attributes. SBI customers are more satisfied on various attributes pertaining to 'Availing loan from the bank'. From the study it is clear that availing loan from a private sector bank HDFC is a complex process when compared to public sector bank SBI. HDFC bank should peg on various attributes to improve the customer satisfaction.

SUGGESTIONS:

Banking Industry is jam-packed with different public and private banks trying to have a sizable market share, demanding exceptional customer services in a competitive landscape. With technological advancement and ever-changing needs, customers' preferences and buying behavior shift constantly; banks should evolve accordingly and look out for innovative products/services to meet the likes of modern era customers.

In order to keep up with the needs of the customers and growing competition, banks must concentrate on financial literacy, segment and marginalize customer base, accuracy and consistency across all channels, empowering employees, and allowing customers for self-services.

CONCLUSION:

Retail banking plays vital role in the development of Indian banking sector. Through the various products of banking, customer feels satisfaction only when the services reached to the bottom level. Since retail banking requires mass production techniques, the advent of technology has enabled the banks to design appropriate technology-based delivery channels. Retail banking has also received a thrust from the regulators/policymakers' push for inclusive growth in the wake of the global financial crisis. The Governments across the world view banks as the key component in furthering the cause of financial inclusion. And they need to have a clear strategy to deal with these challenges and address these priorities, including considering partnerships with third parties and applying lessons from other industries.

REFERENCES:
1. Lee, S-P., and Moghavvemi, S. (2015), "The dimension of service quality and its impact on customer satisfaction, trust, and loyalty: A case of Malaysian Banks", *Asian Journal of Business and Accounting, 8(2)*, 91-121.
2. Pareek, V. (2014), " An empirical investigation of the causal determinants of customer satisfaction: a study of Indian Banks*", IUP Journal of Management Research, 13(2),* 55-73.
3. Director, Automation & Electronics at Frost & Sullivan, Niju V, Frost & Sullivan report,
4. Schumpeter JA (1961), "The theory of economic development: an inquiry into profits, capital, credit, interest, and the business cycle", Translated from the German by Redvers Opie (1961) New York: OUP.
5. Ms Shyamala Gopinath (2005), Deputy Governor of the Reserve Bank of India, at the IBA - Banking Frontiers International Conference on "Retail Banking Directions: Opportunities & Challenges", Mumbai, 28 May 2005.
6. K.Sumavally, Dr.K.Hema Divya (2018), "A study on Digital payments in India with perspective of consumer's adoption", *International Journal of Pure and Applied Mathematics*, Volume 118 No. 24 2018.

7. Dave, Isha and Patel, Raaj (2020), "A Study on Customer Preference Towards Usage of Debit Card in Ahmedabad City". The *IUP Journal of Management Research,* Vol. XX, No. 1, January 2021, pp. 20-34.

8. K. Harichandana and Md.Sohail Baba (2020), "A Study On Loans And Advances Of Commercial Banks", International Journal of Emerging Technologies and Innovative Research (www.jetir.org), ISSN:2349-5162, Vol.7, Issue 8, page no.222-226, August-2020.

ANTIBACTERIAL ACTIVITY OF HEALTHCARE PRODUCTS "LOWSONIA INERMIS AND INDIGOFERA TINCTORIA"

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ABSTRACT

Lowsonia inermis commonly known as" **HENNA**" belongs to the family Litheracae. Henna is widely used as herbal medical all over the world since centuries as an antimicrobial agent and is sometimes also applied directly to the affected area for dandruff, eczema, scabies, wounds, infectious diseases and helminthiasis and as herbal hair and skin dye. **INDIGO** dye is Indigofera tinctoria distinctively blue in color and it's basically an organic compound. It's a synthetic dye. Soxhlet and cold percolate extraction methods were investigated for isolation and biological evaluation of bioactive compounds of henna and indigo. Obtained results showed that soxhlet extraction at higher temperatures, the yield and recovery decreased due to the degradation of the thermos reactant compounds at several temperature conditions. Antibacterial effects of water, methanol extracts of L.inermis leaves and Indigo dye against clinical bacterial cultures were investigated and compared with standard antibiotics of Ciprofloxacin and Ampicillin. The bacterial isolates were treated with L.inermis methanol extracts were more effective than the water extract using standard method of NCCL, 2000.

KEY WORDS: Lawsonia inermis, Indigofera tinctoria , Extraction , Antibacterial activity, Herbal Medicine

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INTRODUCTION

Nature is full of beautiful colours that attract human attention. Natural dyes have been used since ancient times for dyeing of body, food, walls of caves, textiles, leather and objects of daily uses (Kramell, A. et al) India has a rich biodiversity and it is not only one of the world's twelve mega diversity countries, but also one of the eighth major center of origin and diversification of domesticated taxa (Iqbal Sanjeeda and Ansari Taiyaba N.*2014) In the past, painters had used natural dyes extracted from plants, insects, molluscs and minerals for their paintings. The unique character of their works were the result of using different mixtures of dyes and mordents, as varnishes and lacquers responsible for cohesion of the pigments and protection of the layers destroyed by environmental effects. Natural dyes were also used in clothing's as well as in cosmetic industry (Henna, Catechu), pharmaceutical industry (Saffron, Rhubarb) and in food industry (Annatto, Curcumin and Cochineal) (Mohd Yusuf .et.al) The present study aimed at evaluating the natural antimicrobial activity of Lawsonia inermis (*L.* inermis) and Indigofera tinctoria (I. tinctoria) against a reference and pathogenic clinically isolated strains compared with some antibiotics. Many studies on Lawsonia inermis leaves extractions showed that it had antibacterial activity against Gram positive bacteria and against Gram negative bacteria.

Natural dyes are used to impart colour to an infinite variety of materials such as textiles, paper, wood etc. , but also widely used in cosmetic, food and pharmaceutical industry. They have very wide range of medicinal importance in pharmaceutical industry. (B.CHENGAIAH* et.al)

Synthetic dyes are manufactured from organic molecules playing more and more important roles in our modern life with applications both in industry (e.g., paint industry) and also in scientific laboratories (e.g., fluorescent tracers and photoredox catalysts). Synthetic dyes are sometimes referred to as 'coal tar dyes', since they are manufactured from substances which until recently were only obtained from coal tar (Ghodsi Mohammadi Ziarani et.al)

Henna (Lawsonia inermis, family Lythraceae) is a shrub cultivated in Asian countries India, Sri Lanka and North Africa and contains the active dye named lawsone (2-hydroxy-1,4-naphthoquinone). Henna dye is obtained from the dried leaves, which are powdered and mixed with oil or water and are used to prepare hair and body dyes.(Ik-Joon Kang,Mu-Hyoung Lee et ,al) Henna, this is widely used in the cosmetic industry as dyeing agent. It has medicinal importance along with dyeing property (B.CHENGAIAH*et. al) the pigment lawsone (2-hydroxy-1, 4-naphthoquinone; CI 75480; Natural Orange 6), which is present at a concentration of < 2% in henna leaves and natural henna preparations (Almeida P J et.al) In Arab countries, henna is used for medicinal purposes, for the treatment of boils and folliculitis, by mixing it with vinegar and making a hot poultice. It may also be used to reduce pain, swelling, and high fevers, and to treat alopecia, burns, headaches, and gastrointestinal symptoms; in addition to this, henna has alleged antimycotic, tuberculostatic and also ultraviolet A-blocking properties (Anton C. de Groot 2013) In the industrial sector, the powdered form is used by Muslims and Orthodox Jews, because they refuse to use synthetic dyes to tinge silk, wool, and cotton fabrics . In India, surgeons use henna as a durable preoperative skin marker (Mehendale V G et.al). In the past 15 years, a new mode of henna applications called temporary black henna tattoo also sometimes called skin painting or pseudo-tattooing , has become

fashionable. Black henna sometimes also termed blue henna, is the combination of red henna and PPD. No natural black henna exists in real. Some of these 'henna' preparations do not even contain red henna at all (Almeida P J et.al) PPD is added to henna to accelerate dyeing and drying process to strengthen and darken the colour, to enhance the design pattern of the tattoo, and make the tattoo last longer. (Anton C. de Groot 2013)

Indigo Dye is one of the most oldest textile dyes and was originally prepared from the plant material. The most effective plant-based process of producing indigo dye involved by the plant Indigofera tinctoria, which is been distributed throughout the tropical and subtropical regions of the world and particularly in India. In fact, Greeks referred to this dye as "indikon" which means it is "from India." (Gilbert et al. 2004) Nowadays, indigo is also chemically synthesized at a large scale to satisfy the demand for dyeing the jeans. The current indigo production processes are mainly based on fossil feed stocks (Andrea N. Fabara et. al) Indigo dye is mostly used to dye denim fabric in recent era (Ramya et al., 2008) . Its high toxicity has also been reported recently (Barka et al., 2008) . Because it is recalcitrant to the activated sludge system of decolorization, Bacterial, fungal, and enzymatic decolorization of indigo (Barka et al., 2008; Ramya et al., 2008; Birhanli and Yesilada, 2010; Terres et al., 2014)

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EXPERIMENTAL METHODS

HENNA

SAMPLE COLLECTION AND DRYING:

Lawsonia inermis (Henna) leaves were collected about 1kg from private gardens at Visakhapatnam city. The leaves were separated from the stem. These leaves were left to dry under shade at room temperature for about a week or two weeks. These leaves should be completely dry so that there no moisture present in them.

EXTRACTION OF LOWSONE:

The dried leaves are manually smashed until they are finely powdered. This powdered sample is weighed around 50 gm. as shown in fig: 1, and soaked in 1ltr of distilled water or tap water for about 24 hrs. in a henna jar. This soaking results the chemical compounds to drain down into water from the dry leaf powder. This reaction was carried out in a dark reaction at room temperature called cold mastication .This is the important step were the main colouring compound lawsone was observed in soaked water. This soaked sample was filtered after 24 hrs.' This filtration takes more time than a day. The filtrate was separated by removing the solid debris in one beaker and liquid matter in conical flask. This leaf debris can be used for other research purposes. And the liquid is collected about 500 ml in a flask.

DRYING:

The soaked liquid was poured a petri plat and left for drying as shown in the fig: 2 . Another method of extraction is by soxhlet extractor also a chemical way of extracting the lawsone compound.

- **Water extraction:**

  About 100gm of henna dry leaves were extracted by water extraction. 1litr water was added to 100gm of henna powder. 24 hours soaking was done and filtered the solution. The solid sample was used for other research and liquid was collected and poured in petri plate. This was left for drying in a shade.

- **Methanol extraction:**

  About 100 gm. of Henna dry leaves were extracted by means of methanol extraction. 600ml of methanol was added for Henna dry leaf powder. Distillation process was

carried out in soxhlet extractor. The extracted liquid is poured in petri plat and allowed to dry in shade till it is completely powdered.

Fig. 1 - Dry powdered sample   **Fig . 2 – Drying the henna methanol extract**

ANTIBACTERIAL ACTIVITY:

Anything that destroys bacteria or suppresses their growth of their ability to reproduce heat Chemicals such as chlorine and antibiotic drugs all have antibacterial properties many antibacterial products for cleaning and hand washing are sold today such protect do not reduce risk of symptoms of the viral infections diseases in the other ways healthy persons this does not preclude the potential contribution of antibacterial products to reducing symptoms of bacterial diseases in the home.Antimicrobial assessment performed in vitro using the cat description method Antibacterial activity of Nano carriers for lawsone compound was tested in vitro by measuring zone of inhibition against suitable microorganisms such as Escherichia coli, Sthinogomonas paucimobilis and klebsiella pneumonia. The microorganisms of interest were grown on a compatible sterilized nutrient agar medium. Test composites on square plastic grids or disks were transferred on the solidified agar medium and incubated for 24 hrs.' at 37 degree Celsius. After the incubation period, the zones of inhibition were observed in four directions for each sample.

TLC FOR LAWSONE:

The extracted compound of lawsone was taken as sample for testing the presence of compound by thin layer chromatography (TLC) method. The sample was taken and solvent was prepared. The TLC paper was marked to add the sample, to know the initial length. The

sample was added drop wise and dipped in the TLC solvent. Observe the results and note the length of the compound movement in TLC paper. RF is calculated according to the observed value

INDIGO:

SAMPLE COLLECTION: Sample was collected from healthcare laboratories and conducted antimicrobial and antifungal activity.

ANTIBACTERIAL ACTIVITY:

The antibacterial activity for Indigo sample was carried out by preparing nutrient agar medium. The two samples of Indigo were tested. After nutrient agar medium is solidified the disk diffusion method was carried out by making the sample diluted in water and methanol. The bacterium used in identifying the bacterial activity is Escherichia coli, klebsiella pneumonia, Sphingomonas paucimobilis strains. The activity is tested after incubation for 24hrs at room temperature in laminar airflow. If the inhibition is present the media shows the disk formation and if not present then there is no antibacterial activity present for the tested sample such as Indigo.

Fig . 3 Indigo extract

RESULTS AND DISCUSSION:

Two different types of antimicrobial activity test were conducted on three different bacterial strains selected for this study for the first test the Agar dilution method was used to determine the minimal inhibitory concentration (MIC) of antimicrobial agents which is the lowest concentration of the antimicrobial agent that will inhibit the visible growth of microorganism in question the second test was the disc diffusion method which is measurement of the diameter of a ring that forms around the colony after treatment. No formation of disk means that there was no antimicrobial activity and differing exists the size of the Ring indicates the degree of antimicrobial activity Agar dilution method is considered to be the reference method for their other antimicrobial susceptibility test because of its accuracy the disc diffusion method . The extracted henna gave about 15gms of lawsone compound per 1kg of henna leaves.The results showed that methanol and water showed results of inhibition to the tested strains of bacteria.

The antibacterial activity of Henna lowsone compound and Indigo dye was as follows.

TLC FOR LAWSONE COMPOUND:

Different samples of lawsone extract was collected and tested for Thin layer chromatography. The different samples are Henna methanol, Henna chloroform, and henna water. Amongst these three henna methanol showed highest Rf values compared to chloroform and water samples as shown in the fig .4
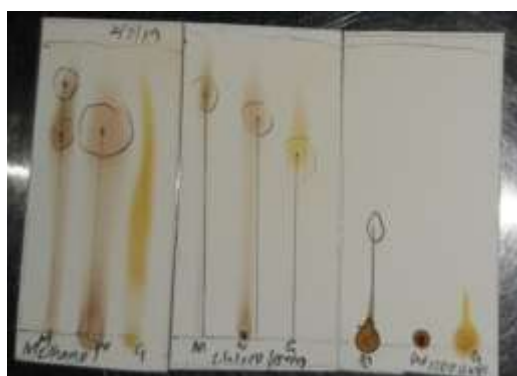
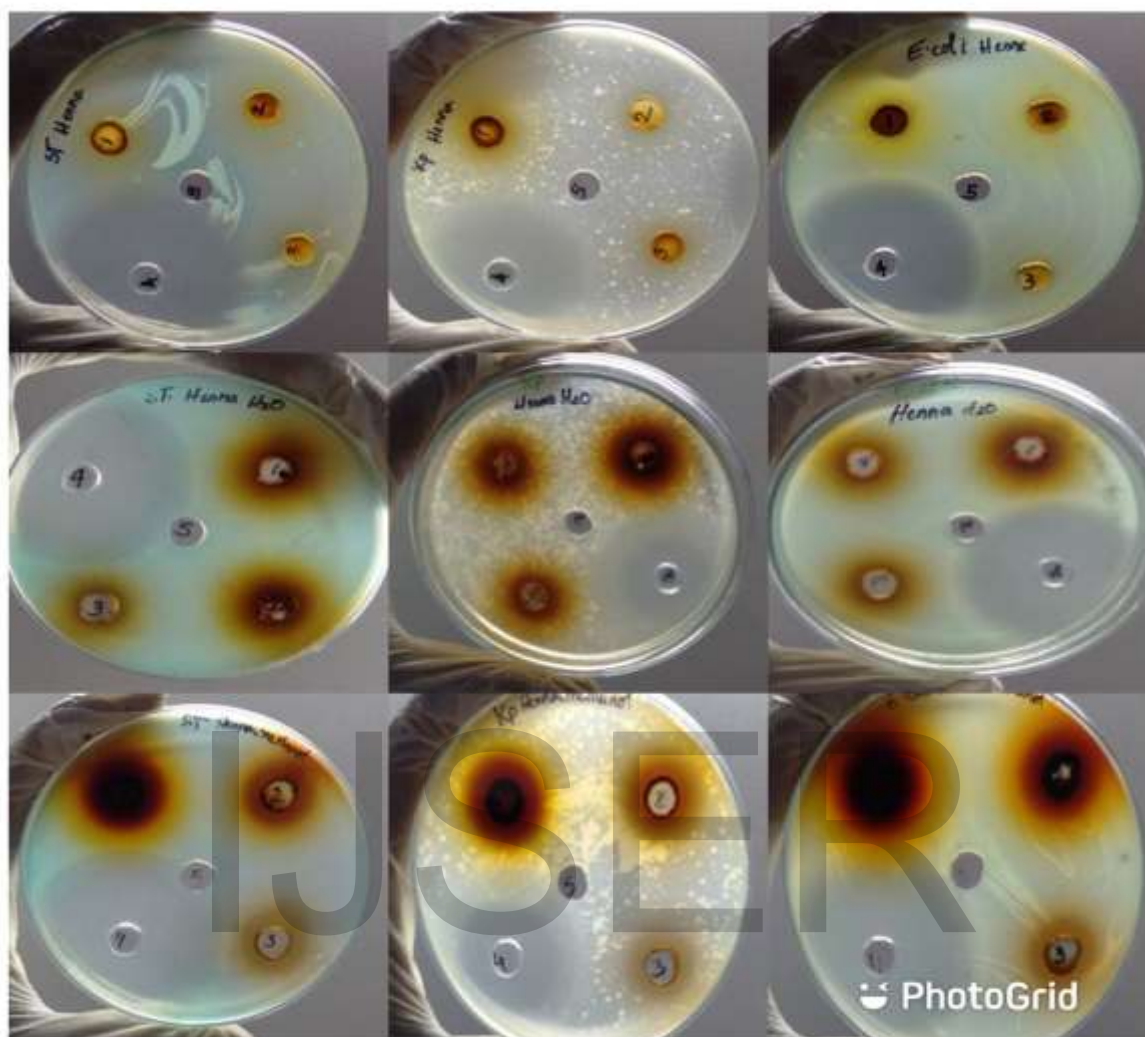**Fig . 4 Thin layer chromatography for extracted lowsone compound**

Fig. 5 Zone of inhibitions in Lowsonia inermis synthetic dye ,Henna water and Henna methanol extracts using bacterial strains such as Sphingomonas paucimobilis, Klebsiella pneumonia , Escherichia coli
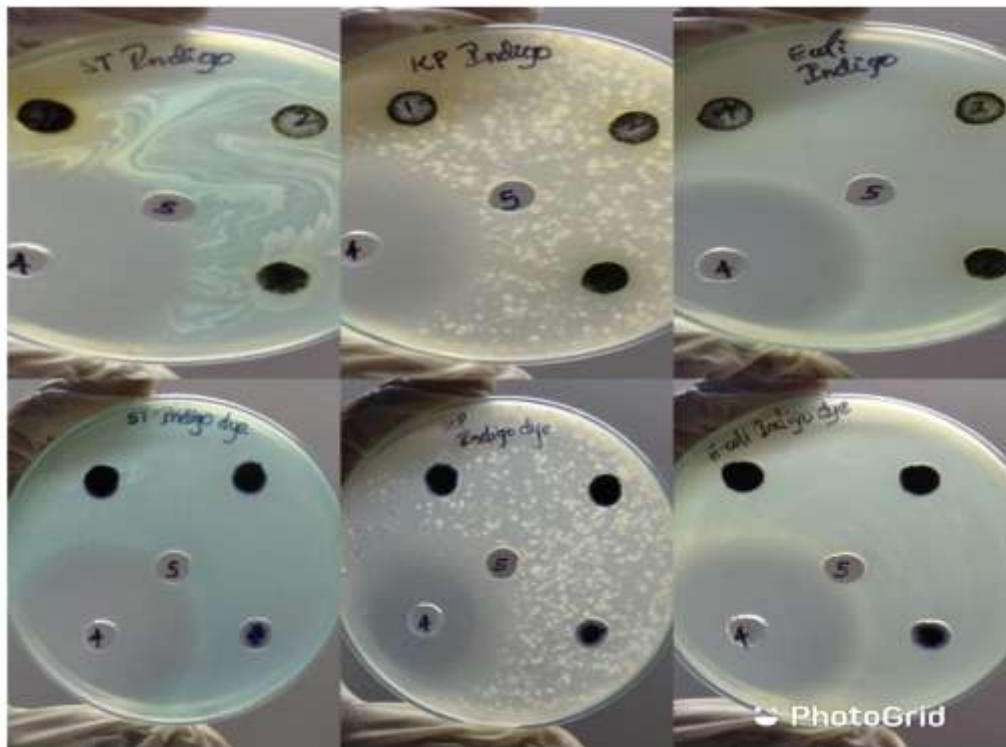
Fig. 6 Zone of inhibitions in Indigofera tinctoria synthetic dye extracts using bacterial strains such as Sphingomonas paucimobilis, Klebsiella pneumonia , Escherichia coli

Henna methanol , antibacterial activity by klebsiella pneumonia showed highest antibacterial activity with 13mm diameter.

Henna water, Antibacterial activity were klebsiella pneumonia showed highest antibacterial activity with 18mm diameter.

Indigo Antibacterial activity, 10mm is the highest activity seen in all the bacterial strains.

Tab : 1 Antibacterial activity zone of inhibition results table

Indigo	1000mg/ml	500mg/ml	250mg/ml	Antibody
Sphingomonas paucimobilis	10mm	9mm	8mm	40mm
Klebsiella pneumonia	10mm	9mm	8mm	40mm
Escherichia coli	10mm	9mm	8mm	40mm
Henna water	**1000mg/ml**	**500mg/ml**	**250mg/ml**	**Antibody**
Sphingomonas paucimobilis	11mm	13mm	12mm	40mm
Klebsiella pneumonia	18mm	15mm	14mm	37mm
Escherichia coli	14mm	13mm	11mm	40mm
Synthetic Henna	**1000mg/ml**	**500mg/ml**	**250mg/ml**	**Antibody**
Sphingomonas paucimobilis	12mm	11mm	10mm	40mm
Klebsiella pneumonia	12mm	13mm	12mm	40mm
Escherichia coli	11mm	10mm	9mm	40mm
Indigo dye	**1000mg/ml**	**500mg/ml**	**250mg/ml**	**Antibody**
Sphingomonas paucimobilis	11mm	11mm	10mm	40mm
Klebsiella pneumonia	11mm	10mm	07mm	40mm
Escherichia coli	11mm	10mm	09mm	40mm
Henna methanol	**1000mg/ml**	**500mg/ml**	**250mg/ml**	**Antibody**

Sphingomonas paucimobilis	12mm	11mm	10mm	40mm
Klebsiella pneumonia	13mm	11mm	10mm	40mm
Escherichia coli	13mm	11mm	10mm	40mm

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CONCLUSION:

The present work shows that plant extract such as Lawsone and Indigo dyes were active against E. coli, klebsiella pneumonia and Sphingomonas paucimobilis that are pathogenic to humans where can be inhabited by lawsone and Indigo compounds. Indicant showed antibacterial activities in the tested strains. Some of the tested strain show significant differences in their responses to the extracts by disk diffusion method.Primary vision caused by the methanol extract water extract of Indigo was observed partially , therefore it can be hypothesized that the basic dye of Indigo, henna contain a wide spectrum of antibacterial compounds with maximum 18mm diameter in the media.

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REFERENCE

1. Natural Colorants: Historical, Processing and Sustainable Prospects Mohd Yusuf,[1] Mohd Shabbir,[2] and Faqeer Mohammad[2]

2. Medicinal importance of natural dyes review B.Chengaiah* , K.Mallikarjuna Rao, K.Mahesh Kumar, M.Alugusundaram, C.Madhusudhana Chetty.

3. Natural Dyes : Their sources and ecofriendly use as textile materials Iqbal Sanjeeda and Ansari Taiyaba N.*

4. Kramell, A. et al.: Dyes of Late Bronze Age textile clothes and accessories from the Yanghai archaeological site, Turfan, China: Determination of the fibers, color analysis and dating. Quaternary international (2014), 348: 214-223

5. Habbal O. et al. "Antibacterial activity of Lawsonia inermis (Henna) against Pseudomonas aeruginosa." *Asian Pacific journal of tropical biomedicine* 1.3 (2011): 173-176.

6. Introduction and Importance of Synthetic Organic Dyes Ghodsi Mohammadi Ziarani, ... Hendrik G. Kruger, in Metal-Free Synthetic Organic Dyes, 2018

7. Quantification of para-phenylenediamine and heavy metals in henna dye Ik-Joon Kang, Mu-Hyoung Lee

8. Side-effects of henna and semi-permanent 'black henna' tattoos: a full review Anton C. de Groot

9. Almeida P J, Borrego L, Pulido-Melián E, González-Díaz O. Quantification of p-phenylenediamine and 2-hydroxy-1,4-naphthoquinone in henna tattoos. *Contact Dermatitis* 2011: **66**: 33– 37. Wiley Online LibraryCASPubMedWeb of Science®Google Scholar

10. El-Shaer N S, Badr J M, Aboul-Ela M A, Gohar Y M. Determination of lawsone in henna powders by high performance thin layer chromatography. *J Sep Sci* 2007: **30**: 3311– 3315. Wiley Online LibraryCASPubMedWeb of Science®Google Scholar

11. Mehendale V G, Chaudhari N C, Shenoy S W et al. Henna is a durable preoperative skin marker. *World J Surg* 2011: **35**: 311– 315. CrossrefPubMedWeb of Science®Google Scholar

12. Ramya M , Anusha B , Kalavathy S (2008.). Decolorization and biodegradation of indigo carmine by a textile soil isolate Paenibacillus larvae . *Biodegradation* 19 : 283 - 291 . [PubMed] [Google Scholar]

13. Barka N , Assabbane A , Nounah A , Ichou YA (2008.). Photocatalytic degradation of indigo carmine in aqueous solution by TiO2- coated non-woven bfires . *J Hazard Mater* 152 : 1054 - 1059 . [PubMed] [Google Scholar]

14. Birhanli E , Erdogan S , Yesilada O , Onal Y (2013.). Laccase production by newly isolated white rot fungus Funalia trogii: effect of immobilization matrix on laccase production . *Biochem Eng J* 71 : 134 - 139 . [Google Scholar]

15. Gilbert KG, Maule HG, Rudolph B, Lewis M, Vandenburg H, Sales E, Tozzi S, Cooke DT. Quantitative analysis of indigo and indigo precursors in leaves of Isatis

spp. and *Polygonum tinctorium. Biotechnol Prog.* 2004;20:1289–1292. [PubMed] [Google Scholar]

16. Appl Microbiol Biotechnol. 2020; 104(3): 925–933. Published online 2019 Dec 13. doi: 10.1007/s00253-019-10292-5 PMCID: PMC6962290 PMID: 31834440 An overview of microbial indigo-forming enzymes Andrea N. Fabara and Marco W. Fraaije⊠

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Reading Comprehension and Reading Models

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Abstract
Reading occupies a crucial role in shaping the future of a nation. Reading opens doors to the treasure of knowledge. In any language, comprehension is the cornerstone on which the superstructure of expression is built. Comprehension is the pliant side of language learning. There are two aspects to comprehension. It might result from the language when it is spoken, or it might result from the reading of the written material. This paper discusses five models of reading and their impact on reading comprehension.

Keywords: Reading, Comprehension, Reading Models

Reading and Comprehension

Traditionally, reading is viewed as a two-component process: decoding and comprehension. Decoding is considered to be the visual analysis of the printed material, and comprehension is getting the meaning from the decoded material. Lately, many researchers have suggested a third component to reading: metacognition. It is suggested that metacognition is "the ongoing activity of evaluating and regulating one understands of written (or spoken) text" (Casanave, 1988: 283). Goodman (1988) considers reading to be a "psycholinguistic guessing game". He believes that meaning does not come just from the printed letters but that there is interplay between thought and language. While reading, readers hypothesise ideas, predict and guess what will come next, and then test and check those predictions. Smith (1971) also holds a similar view. He claims that reading is not a passive reception of meaning from the text but an active ongoing process. He is of the opinion that reading makes use of the interaction between the reader's knowledge and the text. This knowledge includes syntax, grammar, semantics and the word in general. Fry opines that "(I)t is very difficult to define reading comprehension. Reduced to its simplest elements, it might be said that comprehension is a part of the communication process of getting the thoughts that were in the author's mind into the reader's mind" (24).The most widespread view is that reading is a bilateral process involving understanding the word and knowledge of the language. They interact and coordinate to facilitate the understanding of the text (Williams and Moran, 1989). Therefore, it can be said that comprehension is affected by the reader's background, purpose and strategy. Since the intellectual outcome of the reading process is comprehension, it can be said that if a person wants to obtain pleasure and profit, enjoyment and information, comprehension of the reading material is a 'MUST'. Russel has pointed out that "The purposes of the reader, the physical condition of the reader, his interest in the material, and the difficulty of the selection have a bearing on comprehension. The skills involved in Reading Comprehension are numerous and interrelated. Word recognition is a prerequisite to comprehension" (353).

Reading

Reading is a highly complex information processing in which the reader interacts with a text in order to (re)create meaningful discourse (Silberstein, 1994: 12). It involves many components simultaneously. First, the reader should be able to perceive the elements of the code – are these elements letters of the alphabet or signs and symbols.

Then the reader should be able to distinguish them. Then, following the original code and the language writing system, the reader should be able to decode these elements. The reader should know the meaning of the words and the relations between these words. These relations become more meaningful in their positions and functions in the sentence if the reader possesses this knowledge. That is to say, the reader should have an inherent syntactic structure of the language of the original code. After that, the association of the world to the meanings of these words follow. Finally, the reader should be able to hold together these meanings and their outcomes in order to get the suggested meaning intended by the writer.

Here, the word 'outcomes' implies 'reading between the lines', or to put it more clearly, the comprehension of the text. These elements interact in parallel processing and, therefore, are not necessarily in the same 'logical' view expressed above. Presently, the widely-held view divides this processing into two types—top-down processing, in which general predictions are made first and then checked against the incoming information, and bottom-up processing, which occurs when the reader ascertains the incoming data first and then makes inferences about the prevailing situation. Advanced readers apply both processes almost automatically and simultaneously. Generally speaking, native speakers lean towards top-down processing, whereas second language readers lean towards bottom-up processing. These models are discussed in some detail below.

Reading Models
According to Urquhart and Weir (1998), reading models can be divided into two major types: The process models and componential models. Componential models describe what factors are included in the reading activity, whereas process models try to explain how factors work and interact during reading.

Process Models
Most literature on reading refers to the bottom-up models, top-down models, and interactive models.

The following is a discussion on how they influence reading and comprehension.

The Bottom-up approach: The most popular is that of Gough's (1972), in which the reader starts with the small units of the text, that is, letters. These letters are recognised by a scanner. After that comes the transfer of the information to a decoder, which converts these letters into systematic phonemes. This string of phonemes is thus passed to the Librarian, and with the help of the lexicon, it is recognised as a word. Now the word can be uttered (as is the case in reading aloud). Then the reader fixates on the following word and continues processing words in the same way to the end of the sentence. Finally, they proceed to a component, in which syntactic and semantic rules assign a meaning to the sentence.

Top-down Approach: The term 'top-down' implies the opposite of the term 'bottom-up'. In reality, it does not exist. We do not begin by looking at the whole text down to the sentence and then down to the letter: It is argued that "the term is used to refer to approaches in which the expectations of the reader play a crucial, even dominant, role in the processing of the text" (Urquhart and Weir, 1998: 42). The reader comes up with hypotheses, then reads and verifies his hypotheses, checks and tests his guessing (Goodman 1967). The top-down approaches are usually associated with Goodman (1967) and Smith (1971, 1973).

Interactive Approach: If in the bottom-up model the process of reading is thought to be sequential, in the interactive model, it is simultaneous, in the sense that all patterns and elements from different sources interact simultaneously to synthesise comprehension. Interactive approaches are accredited to two authors: Rumelhart (1977) and Stanovich (1980). Urquhart and Weir (1998: 45) provide a summary of Rumelhart's model:

> ... once a Feature Extraction Device has operated on the individual Information Store, it passes the data to a Pattern Synthesiser which receives input from Syntactical,

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Semantic, Lexical and Orthographic Knowledge, all potentially operating at the same point.

Componential models

The process models try to describe the actual reading process and how it really occurs and comes into existence. On the other hand, the componential models do not try to explain the process, but they tell us which components are involved in the reading process. They, in fact, provide us with a description of skills involved in it, namely, word recognising and knowledge are thought to influence the reading ability rather than the reading process. The following paragraphs describe these models briefly.

The Two-Component Model: This model was first introduced by Hoover and Tummer (1993), to which they refer as 'the simple view'. It consists of two components: word recognition and linguistic comprehension. They claim that Fry (1963) and others share the same view. Hoover and Tummer (1993) provide evidence to 'prove' that these two variables are separable. The strongest evidence is that L1 illiterates understand the language but cannot decode it. People with dyslexia are linguistically competent, but they are deficient decoders on the other hand. Children suffering from hyperlexia have high decoding skills, but they generally show low linguistic comprehension. Finally, longitudinal studies of the correlation between decoding and comprehension show that these two variables are low in the early stages of learning but become steadily high as the children advance in the early stages of learning.

The Three-Component Approach: Coady (1979) and Bernhardt (1991) described L2 reading as consisting of three variables. For Coady, these variables are Conceptual Abilities, Process Strategies and Background Knowledge. Conceptual abilities are similar to intellectual capacity, which might explain the failure of foreign students to achieve the competence necessary for university instruction, not

because they cannot learn English but because they lack background knowledge. But for Coady, it is not an addition to comprehension, but it is a component of it. Process strategies mean both knowledge of the language system and the ability to use this knowledge. Urquhart and Weir (1998) point out that Coady's model lacks a vital component which is found in Hoover and Tunmer's (1993) model: "The only acknowledgement Coady makes of this is to include phoneme/grapheme correspondences as part of the process strategies component" (50).

Bemhardt's (1991) model also consists of three variables: Language, Literacy and World Knowledge. World knowledge equals background knowledge. Language includes those elements perceived from the text, such as word structure, word meaning, syntax and morphology. Like Coady in this component, she lacks a separate word-recognition component. "Literacy equals operational knowledge – knowing how to approach text, knowing why one approaches it and what to do with it" (Hoover and Tunmer, 1993: 50).

Conclusion

Thus, we have five types of models for reading and how they are viewed. Indeed, they are all important in understanding reading comprehension. Unless we know the components of reading, we may not be able to understand how the reading process operates. A model that was created by Just and Carpenter (1980) and expanded by Urquhart and Weir (1998) is given below. This model is the most comprehensive of many models proposed earlier. It integrates both process and componential types of models. It shows how they complement each other and how interaction and coordination between different elements of 'reading and comprehension' are achieved through the monitor. In this model, the monitor is central, and it seemingly represents the mental consciousness and strategies awareness, as we would prefer to call it.
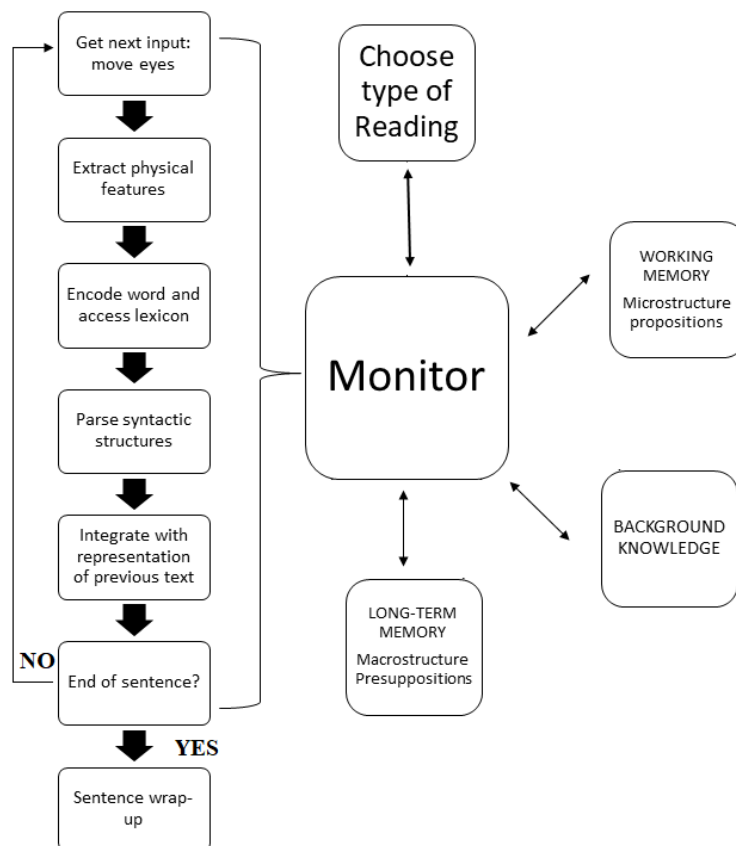
A Model for Reading based in Urquhart and Weir (1998)

References

Bernhardt, E. B. *Reading Development in Second Language: theoretical, empirical, and classroom perspectives*. Norwood, NJ: Ablex Publishing Corporation, 1991.

Casanave, Christine Pearson. "Comprehension Monitoring in ESL Reading: A Neglected Essential." *TESOL Quarterly*, vol. 22, no. 2, 1988, pp. 283-302.

Coady, J. "A psycholinguistic model of the ESL reader." *Reading in a Second Language*, edited by R. Mackay, B. Barhman and R. R. Jordan, Rowley, Mass: Newbury House, 1979, pp. 5-12.

Dechant, Emerald V. *Improving the Teaching of Reading*. New Delhi: Prentice-Hall of India Private Limited, 1969.

Fry, Edward L. *Reading Faster: A Drill Book*. Cambridge: Cambridge University Press, London, 1963.

Fry, Edward L. *Teaching Faster Reading*. Cambridge University Press, London, 1963.

Goodman, K. S. "Reading: A Psycholinguistic Guessing Game." *Journal of the Reading Specialist*, vol. 6, no. 4, 1967, pp. 126-135.

Gough, P. P. "One Second of Reading." *Language by Ear and Eye*, edited by J. P. Kavanagh, and I. G. Mattingly, Cambridge: M.I.T. Press, 1972, pp. 331-335.

Hoover, W. A., and Tunmer, W. E. "The components of reading." *Reading Acquisition Processes*, edited by G. B. Thompson, W. E. Tunmer, and T. Nicholson, Clevedon: Multilingual Matters, 1993, pp. 1-19.

Just, M. A., and Carpenter, P. A. "A theory of reading: from eye fixations to comprehension."

Psychological Review, vol. 87(4), 1980, pp. 329-54.

Russel, D. H. *Children Learn to Read. Teaching Reading: A Challenge*. NCERT, Publication Unit, 1966.

Silberstein, Sandra. *Technique and Resource in Teaching Reading*. New York: Oxford University Press, 1994.

Smith, F. *Understanding reading: A psycholinguistic analysis of reading and learning to read*. Holt, Rinehart and Winston, 1971.

Williams, E., and Moran, C. "Reading in a foreign language at intermediate and advanced levels with particular reference to English." *Language Teaching,* 22, 1989, pp. 217-28.

Urquhart, A. H., and Weir, C. J. *Reading in a Second Language: Process, Product and Practice*. 1st ed., London and New York: Longman, 1998.

EXTRACTION AND ANTIFUNGAL ACTIVITY OF LAWSON AND INDIGO COMPOUNDS

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ABSTRACT

Lowsonia inermis commonly known as" **HENNA**" belongs to the family Litheracae. Henna is widely used as herbal medical all over the world since centuries as an antifungul agent and is sometimes also applied directly to the affected area for dandruff, eczema, scabies, wounds, infectious diseases and helminthiasis and as herbal hair and skin dye. **INDIGO** dye is distinctively blue in color and it's basically an organic compound. It's a synthetic dye. Soxhlet and cold percolate extraction methods were investigated for isolation and biological evaluation of bioactive compounds. Obtained results showed that soxhlet extraction at higher temperatures, the yield and recovery decreased due to the degradation of the thermos reactant compounds at several temperature conditions. Antifungul effects of water, methanol extracts of L.inermis leaves and Indigo dye against clinical fungal cultures were investigated and compared with standard antibiotics of Ciprofloxacin and Ampicillin. The fungul isolates were treated with L.inermis methanol extracts were more effective than the water extract using standard method of NCCL, 2000.

KEYWORDS: *Lawsonia inermis*, *Indigofera tinctoria* , Extraction , Antifungal activity, Herbal Medicine.

INTRODUCTION

Nature is full of beautiful colors that attract human attention. Natural dyes have been used since ancient times for dyeing of body, food, walls of caves, textiles, leather and objects of daily uses (Kramell, A. et al) India has a rich biodiversity and it is not only one of the world's twelve mega diversity countries, but also one of the eighth major center of origin and diversification of domesticated taxa (Iqbal Sanjeeda and Ansari Taiyaba N.*2014) In the past, painters had used natural dyes extracted from plants, insects, mollusks and minerals for their paintings. The unique character of their works were the result of using different mixtures of dyes and mordents, as varnishes and lacquers responsible for cohesion of the pigments and protection of the layers destroyed by environmental effects. Natural dyes were also used in clothing's as well as in cosmetic industry (Henna, Catechu), pharmaceutical industry (Saffron, Rhubarb) and in food industry (Annatto, Cur cumin and Cochineal) (Mohd Yusuf et.al) The present study aimed at evaluating the natural antifungal activity of *Lawsonia inermis* (*L. inermis*) and *Indigofera tinctoria* (*I. tinctoria*) against a reference and pathogenic clinically isolated strains compared with some antibiotics. Many studies on *Lawsonia inermis* leaves extractions showed that it

had antifungal activity against Gram positive and against Gram negative fungi.

Natural dyes are used to impart color to an infinite variety of materials such as textiles, paper, wood etc., but also widely used in cosmetic, food and pharmaceutical industry. They have very wide range of medicinal importance in pharmaceutical industry. (B.CHENGAIAH* et.al)

Synthetic dyes are manufactured from organic molecules playing more and more important roles in our modern life with applications both in industry (e.g., paint industry) and also in scientific laboratories (e.g., fluorescent tracers and photoredox catalysts). Synthetic dyes are sometimes referred to as '*coal tar dyes'*, since they are manufactured from substances which until recently were only obtained from coal tar (Ghodsi Mohammadi Ziarani et.al)

Henna (*Lawsonia inermis, family Lythraceae*) is a shrub cultivated in Asian countries India, Sri Lanka and North Africa and contains the active dye named lawson (2-hydroxy-1,4-naphthoquinone). Henna dye is obtained from the dried leaves, which are powdered and mixed with oil or water and are used to prepare hair and body

dyes.(Ik-Joon Kang, Mu-Hyoung Lee et, al) Henna, this is widely used in the cosmetic industry as dyeing agent. It has medicinal importance along with dyeing property (B.CHENGAIAH* et. al) the pigment lawsone (2-hydroxy-1, 4-naphthoquinone; CI 75480; Natural Orange 6), which is present at a concentration of < 2% in henna leaves and natural henna preparations (Almeida P J et.al) In Arab countries, henna is used for medicinal purposes, for the treatment of boils and folliculitis, by mixing it with vinegar and making a hot poultice. It may also be used to reduce pain, swelling, and high fevers, and to treat alopecia, burns, headaches, and gastrointestinal symptoms; in addition to this, henna has alleged antimycotic, tuberculostatic and also ultraviolet A-blocking properties (Anton C. de Groot 2013) In the industrial sector, the powdered form is used by Muslims and Orthodox Jews, because they refuse to use synthetic dyes to tinge silk, wool, and cotton fabrics. In India, surgeons use henna as a durable preoperative skin marker (Mehendale V G et.al). In the past 15 years, a new mode of henna applications called temporary black henna tattoo also sometimes called skin painting or pseudo-tattooing, has become fashionable. Black henna sometimes also termed blue henna is the combination of red henna and PPD. No natural black henna exists in real. Some of these 'henna' preparations do not even contain red henna at all (Almeida P J et.al) PPD is added to henna to accelerate dyeing and drying process to strengthen and darken the color, to enhance the design pattern of the tattoo, and make the tattoo last longer. (Anton C. de Groot 2013)

Indigo Dye is one of the most oldest textile dyes and was originally prepared from the plant material. The most effective plant-based process of producing indigo dye involved by the plant *Indigofera tinctoria*, which is been distributed throughout the tropical and subtropical regions of the world and particularly in India. In fact, Greeks referred to this dye as "indikon" which means it is "from India." (Gilbert et al. 2004) Nowadays, indigo is also chemically synthesized at a large scale to satisfy the demand for dyeing the jeans. The current indigo production processes are mainly based on fossil feed stocks (Andrea N. Fabara et. al) Indigo dye is mostly used to dye denim fabric in recent era (Ramya et al., 2008). Its high toxicity has also been reported recently (Barka et al., 2008). Because it is recalcitrant to the activated sludge system of decolorization, Bacterial, fungal, and enzymatic decolorization of indigo (Barka et al., 2008; Ramya et al., 2008; Birhanli and Yesilada, 2010; Terres et al., 2014)

EXPERIMENT AND METHODS
HENNA
SAMPLE COLLECTION AND DRYING
Lawsonia inermis (Henna) leaves were collected about 1kg from private gardens at Visakhapatnam city. The leaves were separated from the stem. These leaves were left to dry under shade at room temperature for about a

week or two weeks. These leaves should be completely dry so that there no moisture present in them.

EXTRACTION OF LOWSONE
The dried leaves are manually smashed until they are finely powdered. This powdered sample is weighed around 50 gm. as shown in fig: 1, and soaked in 1ltr of distilled water or tap water for about 24 hrs. in a henna jar. This soaking results the chemical compounds to drain down into water from the dry leaf powder. This reaction was carried out in a dark reaction at room temperature called cold mastication. This is the important step were the main colouring compound lawsone was observed in soaked water. This soaked sample was filtered after 24 hrs.' This filtration takes more time than a day. The filtrate was separated by removing the solid debris in one beaker and liquid matter in conical flask. This leaf debris can be used for other research purposes. And the liquid is collected about 500 ml in a flask.

DRYING
The soaked liquid was poured a petri plat and left for drying as shown in the fig: 2. Another method of extraction is by soxhlet extractor also a chemical way of extracting the lawsone compound.

- **Water extraction**
About 100gm of henna dry leaves were extracted by water extraction. 1litr water was added to 100gm of henna powder. 24 hours soaking was done and filtered the solution. The solid sample was used for other research and liquid was collected and poured in petri plate. This was left for drying in a shade.

- **Methanol extraction**
About 100 gm. of Henna dry leaves were extracted by means of methanol extraction. 600ml of methanol was added for Henna dry leaf powder. Distillation process was carried out in soxhlet extractor. The extracted liquid is poured in petri plat and allowed to dry in shade till it is completely powdered.

Fig. 1 - Dry powdered sample.

Fig. 2 – Drying the henna methanol extract.

INDIGO
SAMPLE COLLECTION: Sample was collected from healthcare laboratories and conducted antimicrobial and antifungal activity.

Fig. 3 Indigo extract.

Antifungal activity
The antifungal activity was conducted to identify the activity of Indigo against fungus. Potato dextrose agar medium was prepared for the antifungal activity. This medium was left for solidifying for 24hrs. A negative control was also prepared in the same way using solvent DMSO. The disk diffusion method was carried by using two different fungal strains, they are *aspergilla's Niger* (black fungi) and *Trivhophyton mentagrophytes* (Tmen fungi). These strains were diffused into the media and incubated for 24hrs at room temperature in laminar airflow chamber. This results in the formation of zones or disks which eventually indicate the presence of antifungal properties, and if it is not present it shows no activity towards the fungi.

RESULTS AND DISCUSSION
Two different types of antimicrobial activity test were conducted on two different fungal strains selected for this study for the first test the Agar dilution method was used to determine the minimal inhibitory concentration (MIC) of antimicrobial agents which is the lowest concentration of the antifungal agent that will inhibit the visible growth of microorganism in question the second test was the disc diffusion method which is measurement of the diameter of a ring that forms around the colony after treatment. No formation of disk means that there was no antifungal activity and differing exists the size of the Ring indicates the degree of antifungal activity Agar dilution method is considered to be the reference method for their other antifungal susceptibility test because of its accuracy the disc diffusion method. The extracted henna gave about 15gms of lawsone compound per 1kg of henna leaves. The results showed that indigo and henna showed results of inhibition to the tested strains of fungi. The antifungal activity of Henna lowson compound and Indigo dye was as follows.

ANTIFUNGAL ACTIVITY

- Antifungal activities have been extensively studied. Antifungal activity to observe the growth inhibition and destroying of fungicidal and fungistatic. An antifungal medication also known as an antibiotic medication is a pharmaceutical fungi side or fungus static used to treat various diseases.

- The results showed that Tmen fungi showed the maximum results compared to aspergilla's Niger. The maximum diameter was obtained to Tmen fungi 15mm in Indigo and 14 mm in henna compounds.

Tab: 1 - Antifungal activity results.

Indigo	1000mg/ml	500mg/ml	250mg/ml	Antibody
Aspergillus Niger	10mm	8mm	7mm	
Tmen fungi	*15mm*	13mm	12mm	30mm
Henna water	**1000mg/ml**	**500mg/ml**	**250mg/ml**	**Antibody**
Aspergillus Niger	10mm	12mm	12mm	31mm
Tmen fungi	11mm	13mm	*14mm*	31mm
Henna	**1000mg/ml**	**500mg/ml**	**250mg/ml**	**Antibody**
Aspergillus Niger	11mm	12mm	13mm	37mm
Tmen fungi	10mm	9mm	8mm	31mm
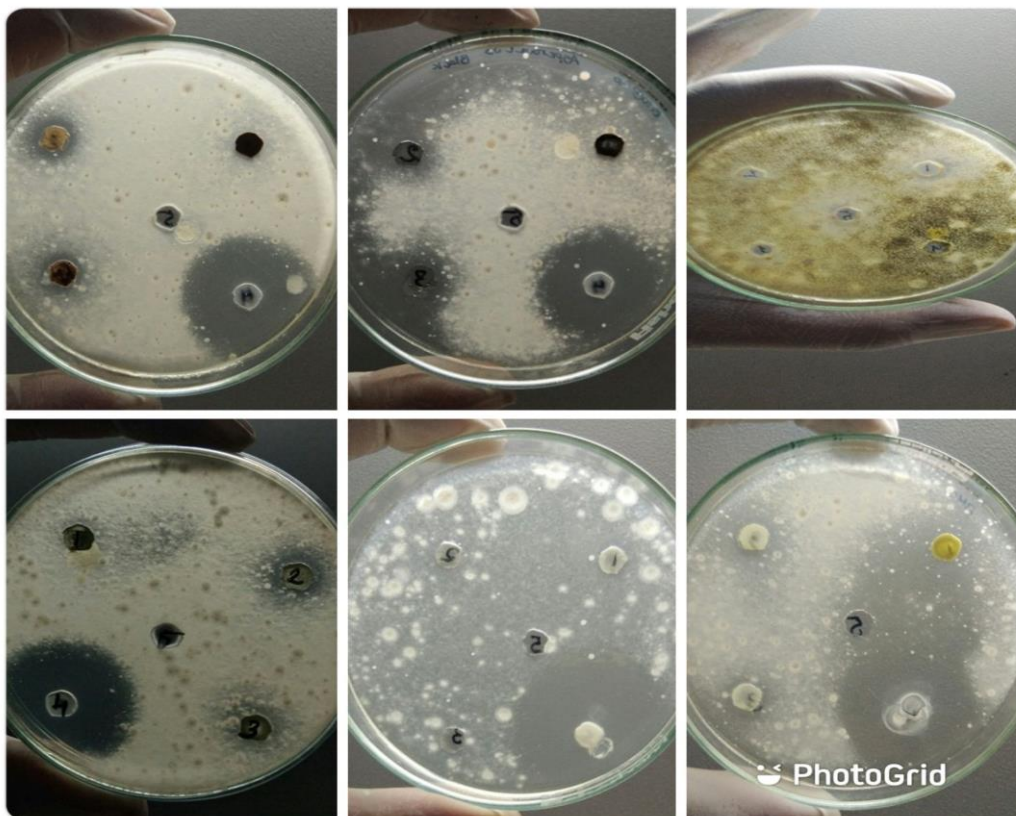
Fig: 4 Antifungal activity of Henna and Indigo dyes.

CONCLUSION

The present work shows that plant extract such as *Lawsone* and *Indigo* dyes were active against Aspergillus Niger and Tmen fungi that are pathogenic to humans where can be inhabited by lawsone and Indigo compounds. Indicant showed antifungal activities in the tested strains. Some of the tested strain show significant differences in their responses to the extracts by disk diffusion method. Primary vision caused by the extract of Indigo and Henna was observed partially, therefore it can be hypothesized that the basic dye of Indigo, Henna contain a wide spectrum of antifungal compounds with maximum 15mm diameter in the media.

REFERENCE

1. Natural Colorants: Historical, Processing and Sustainable Prospects Mohd Yusuf,[1] Mohd Shabbir,[2] and Faqeer Mohammad[2]
2. Medicinal importance of natural dyes review B.Chengaiah*, K.Mallikarjuna Rao, K.Mahesh Kumar, M.Alugusundaram, C.Madhusudhana Chetty.
3. Natural Dyes : Their sources and ecofriendly use as textile materials Iqbal Sanjeeda and Ansari Taiyaba N.*
4. Kramell, A. et al.: Dyes of Late Bronze Age textile clothes and accessories from the Yanghai

archaeological site, Turfan, China: Determination of the fibers, color analysis and dating. Quaternary international, 2014; 348: 214-223.

5. Habbal O. et al. "Antibacterial activity of Lawsonia inermis (Henna) against Pseudomonas aeruginosa." *Asian Pacific journal of tropical biomedicine,* 2011; 1.3: 173-176.

6. Introduction and Importance of Synthetic Organic Dyes Ghodsi Mohammadi Ziarani, ... Hendrik G. Kruger, in Metal-Free Synthetic Organic Dyes, 2018.

7. Quantification of para-phenylenediamine and heavy metals in henna dye Ik-Joon Kang, Mu-Hyoung Lee.

8. Side-effects of henna and semi-permanent 'black henna' tattoos: a full review Anton C. de Groot.

9. Almeida P J, Borrego L, Pulido-Melián E, González-Díaz O. Quantification of p-phenylenediamine and 2-hydroxy-1,4-naphthoquinone in henna tattoos. *Contact Dermatitis,* 2011; 66: 33– 37. Wiley Online LibraryCASPubMedWeb of Science®Google Scholar

10. El-Shaer N S, Badr J M, Aboul-Ela M A, Gohar Y M. Determination of lawsone in henna powders by high performance thin layer chromatography. *J Sep Sci.,* 2007; 30: 3311– 3315. Wiley Online LibraryCASPubMedWeb of Science®Google Scholar

11. Mehendale V G, Chaudhari N C, Shenoy S W et al. Henna is a durable preoperative skin marker. *World J Surg,* 2011; 35: 311– 315. CrossrefPubMedWeb of Science®Google Scholar

12. Ramya M, Anusha B, Kalavathy S (2008). Decolorization and biodegradation of indigo carmine by a textile soil isolate Paenibacillus larvae. *Biodegradation,* 19: 283-291. [PubMed] [Google Scholar]

13. Barka N, Assabbane A, Nounah A, Ichou YA (2008). Photocatalytic degradation of indigo carmine in aqueous solution by TiO2- coated non-woven bfires. *J Hazard Mater,* 152: 1054-1059. [PubMed] [Google Scholar]

14. Birhanli E, Erdogan S, Yesilada O, Onal Y (2013). Laccase production by newly isolated white rot fungus Funalia trogii: effect of immobilization matrix on laccase production. *Biochem Eng J.,* 71: 134-139. [Google Scholar]

15. Gilbert KG, Maule HG, Rudolph B, Lewis M, Vandenburg H, Sales E, Tozzi S, Cooke DT. Quantitative analysis of indigo and indigo precursors in leaves of *Isatis spp.* and *Polygonum tinctorium. Biotechnol Prog.,* 2004; 20: 1289–1292. [PubMed] [Google Scholar]

16. Appl Microbiol Biotechnol, 2020; 104(3): 925–933. Published online 2019 Dec 13. doi: 10.1007/s00253-019-10292-5 PMCID: PMC6962290 PMID: 31834440 An overview of microbial indigo-forming enzymes Andrea N. Fabara and Marco W. Fraaije

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Effect of anionic micelles of sodium dodecyl sulphate on protonation equilibria of L-Methionine and L-Cysteine

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Abstract:

Solute–solvent interactions of L-methionine and L-cysteine are studied in sodium dodecyl sulfate–water mixtures (0.5–2.5% w/v) at 303.0 ± 0.1 K at an ionic strength of 0.16 M using a pH-metric technique. The protonation constants were estimated with the computer program MINIQUAD75. Selection of the best fit chemical model of the protonation equilibria is based on the standard deviation in protonation constants and residual analysis using a sum of squares of residuals in all mass-balance equations. The effect of solvent on protonation constants is discussed based on electrostatic and non-electrostatic forces operating on the protonation equilibria. The distribution of species, protonation equilibria and effects of influential parameters on the protonation constants are also presented.
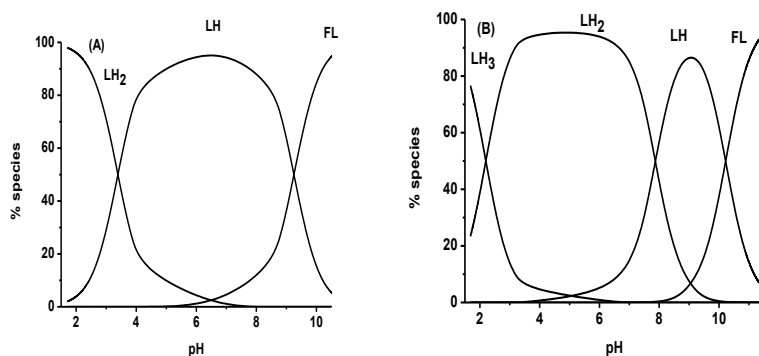
Species distribution diagrams of (A) Met and (B) Cys in 1.5% w/v SLS- water mixture
Keywords: sodium dodecylsulfate, protonation constant, MINIQUAD75, L-methionine, L-cysteine

AIMS AND BACKGROUND

The protonation equilibria of various bio-ligands in surfactant medium are popular in recent years [1–4]. Protonation constants of L-Methionine and L-Cysteine and were determined in other micellar media [5] recently. The present study is an attempt to examine the effect of anionic micelle on the protonation constants of L-Methionine and L-Cysteine. Surfactant is widely used in our life and work. Its basic and application studies in surface chemistry and organic chemistry are always very active, for example, in the interaction with dyes [6, 7, 8–10]. Understanding the interaction of surfactants with organic and inorganic compounds is helpful to investigate the synergistic mechanism of surfactants, like in separation, trace analysis and washing.

1.Introduction

Sodium dodecyl sulphate: Sodium dodecyl sulfate (SDS), synonymously sodium lauryl sulfate (SLS), or sodium lauril sulfate, is a synthetic organic compound which is an anionic surfactant. It is the family of organosulfate compounds and has the formula, $CH_3(CH_2)_{11}SO_4Na$. It consists of a 12-carbon tail attached to a sulfate group, it is the sodium salt of a 12-carbon alcohol that has been esterified to sulphuric acid. It is an alkyl group with a pendant terminal sulfate group attached. As a result of its hydrocarbon tail and its anionic head group, it has amphiphilic properties that allow it to form micelles and so act as a detergent. It is used as an emulsifying agent and whipping aid. It is commonly used as a component for lysing cells during RNA extraction and/or DNA extraction and for denaturing proteins in preparation for electrophoresis in the SDS-PAGE technique. It is synthesized by reacting lauryl alcohol from a petroleum or plant source with sulphur trioxide to produce hydrogen lauryl sulfate, which is then neutralized with sodium carbonate to produce SLS. It is potentially effective topical microbicide, for intravaginal use, to inhibit and possibly prevent infection by various enveloped and non-enveloped viruses such as the herpes simplex viruses, HIV, and the Semliki Forest virus [11]. The toxicity of SLS depends largely on the marine species, water hardness, and water temperature [12, 13, 14].

Methionine (Met) is an essential amino acid which cannot be produced by the body, must be provided by the diet which is found in meat, fish, and dairy products, and plays an important role in many cell functions. It supplies sulphur and other compounds required by the body for normal metabolism and growth. It is the initiating amino acid in the synthesis of eukaryotic proteins; *N*-formyl methionine serves the same function in prokaryotes. It is used to prevent liver damage in acetaminophen (Tylenol) poisoning. It is also used for increasing the acidity of urine, treating liver disorders, and improving wound healing. Cerebrospinal fluid levels of Met, homocysteine and cystathionine were studied in patients with psychotic disorders [15]. Met is synthesized from cysteine and *o*-phosphohomoserine involving three enzymes, cystathionine synthase, cystathionine*ß*-lyaseand methionine synthase [16].

Cysteine (Cys) is a sulphur-containing amino acid in humans, which is important for protein synthesis, detoxification, and diverse metabolic functions. It is widely applied in many fields, like food additives, pharmaceutical industry, feed stuff and cosmetic additives. Currently, four manufacturing methods have been developed to produce L-cysteine. These are acid or alkali hydrolysis of hair, chemical synthesis, microbe fermentation [17] and bioconversion of 2-amino-thiazoline-4-carboxylic acid (DL-ATC)[18]. Bioconversion of DL-ATC by whole-cell biocatalyst, a competent method with advantages of low energy requirement and high molar yield, has being substituted for acid or alkali hydrolysis of hair as a main method for the production of L-cysteine on industrial scale[19]. It is often involved in electron-transfer reactions, and helps the enzyme catalyze its reaction. The sulfhydryl group has a high affinity for heavy metals, so that proteins containing cysteine, such as metallothionein, will bind metals such as mercury, lead and cadmium tightly [20]. Due to this it has the ability to undergo redox reactions, hence cysteine has antioxidant properties

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2. CHEMICALS AND PROCEDURE

0.02 units.

2.1 Reagents: 0.05 mol L^{-1} solutions of L-Methionine (Met) and L-Cysteine (Cys) (Himedia, India) was prepared in triple distilled water by maintaining 0.05 mol L^{-1} acid (HCl) concentration to increase the solubility. SDS (Himedia, India) was used as received. To maintain the ionic strength in the titrant, Sodium chloride (Merck) of 2 mol L^{-1} was prepared. Solutions of 0.4 mol L^{-1} Sodium hydroxide and 0.2 mol L^{-1} HCl were also prepared and were standardized by standard methods.

The titrimetric data were obtained by using calibrated ELICO (Model LI-120) pH-meter (readability 0.01). The glass electrode was equilibrated in a well stirred solvent solution containing inert electrolyte. The effects of variations in asymmetry, liquid junction potential, activity coefficient, sodium ion error and dissolved carbon dioxide on the response of glass electrode were accounted for in the form of correction factor [21]. For the determination of protonation constants of L-Methionine and L-Cysteine, initially titrations of strong acid with alkali were carried out at regular intervals to check whether complete equilibration was achieved. Then the calomel electrode was refilled with solvent solution of equivalent composition as that of the titrand. The titrations were carried out in media containing varying amounts of surfactants maintaining an ionic strength of 0.16 mol dm^{-3} with NaCl at 303K. In these titrations, the titrand consisted of mineral acid and ligand, in the presence and absence of metal ion, in a total volume of 50 cm^3. Titrations were performed by adding each time 0.1cm^3 portions of sodium hydroxide (0.4 mol dm^{-3}) to the titrand. The pH meter reading was recorded only after a constant value was displayed. Typical duplicate titrations showed that equilibration is fast and titration data do not differ by more than

2.2 Alkalimetric titration assembly: The titrations with alkali were performed in media having different compositions of SDS-water (0.5–2.5% w/v) keeping an ionic strength of 0.16 mol L^{-1} with sodium chloride at 303.00 ± 0.05 K using an Elico LI-120 pH meter. The pH meter is calibrated with Potassium hydrogen phthalate (0.05 mol L^{-1}) and borax (0.01 mol L^{-1}) solutions. The glass electrode was equilibrated in a SDS-water mixture containing inert electrolyte for several days. At regular intervals, an acid–base titration was carried out to check for complete equilibration. In each titration, the titrant consists of 1 mmol of hydrochloric acid and 0.25 to 0.50 mmols of the ligand and it is titrated by adding 0.1cm^3 of sodium hydroxide each time to the titrant. The curves for the alkalimetric titrations are given in Figure 1.
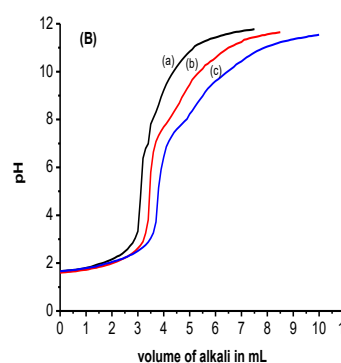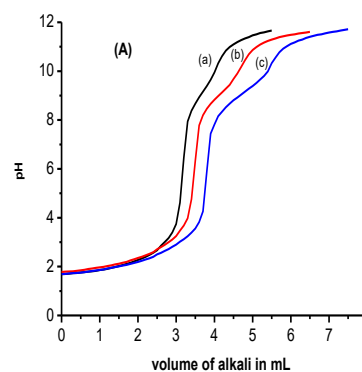
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Figure1. Alkalimetric titration curves in 2.0 w/v SDS-water mixtures: **(A)** Met **(B)** Cys
(a) 0.25, (b) 0.375 and (c) 0.50 mmol, respectively.

2.3 Modeling strategy: The computer program SCPHD was used to apply the correction factor to the pH meter reading. The protonation constants of L-Methionine and
L-Cysteine in different concentrations of SDS- water mixture were calculated using MINIQUAD75. The variation of stepwise protonation constants was examined on the basis of interactions between solute-solute and solute-solvent. The primary alkalimetric data were simulated [22] models.

3. Results and Discussion

The best fit chemical model for each system investigated was arrived at using non-linear least–squares method in the initial refinement and reliable convergence of Marquardt algorithm [**23**]. The variation of stepwise constants was analyzed mainly on electrostatic grounds on the basis of solute-solute and solute-solvent interactions. The results of best fit models that contain the type of species and overall protonation constants of L-Methionine and L-Cysteine in SDS-water mixtures along with some important statistical parameters are given in Table-1. The values of low standard deviation (SD) in log β and Ucorr (sum of the squares of deviations in concentrations of ligand and hydrogen ion at all experimental data points corrected for degree of freedom) show that the experimental data can be depicted by the model. The values of kurtosis in table 1 signify that the residuals form leptokurtic patterns [24]. The skewness values (-0.83 and 0.42) explain that the residuals form a part of normal distribution and therefore, least squares method is applicable to the present data. The acceptability of the model is more apparent from the low crystallographic R-values.

Table 1: Best fit chemical models of protonation equilibria of Met and Cys in SDS-water mixtures
Temp= 303 K, Ionic strength=0.16 mol dm^{-3}.

% w/v SDS	logβ_1(SD)	log β_2(SD)	log β_3(SD)	NP	U$_{corr}$x10^8	Skewness	Kurtosis	χ^2	R-factor
METHIONINE (pH range 1.80-10.80)									
0	8.93(07)	11.17(09)	---	54	26.23	0.42	5.45	5.93	0.0410
0.5	9.01(06)	11.64(09)	---	79	43.53	-4.73	31.12	67.11	0.0408
1.0	9.06(10)	11.48(13)	---	83	93.22	-2.07	9.32	30.53	0.0540
1.5	9.25(03)	12.64(07)	---	39	15.34	-1.11	6.74	19.64	0.0384
2.0	9.06(02)	12.62(04)	---	46	6.02	0.08	4.86	10.61	0.0218
2.5	8.99(03)	12.08(07)	---	38	14.37	-1.75	8.12	25.89	0.0386
CYSTEINE (pH range 1.6-11.40)									
0	10.53(02)	18.67(01)	20.53(09)	60	14.13	-0.83	6.41	22.67	0.0241
0.5	10.55(03)	18.04(02)	19.85(09)	87	86.31	-0.19	3.57	24.53	0.0565
1.0	10.54(06)	18.66(06)	21.09(15)	67	91.06	-0.33	4.25	27.67	0.0619
1.5	10.22(03)	18.09(04)	20.29(12)	95	61.82	-2.89	17.18	69.45	0.0547
2.0	10.66(05)	18.46(07)	21.34(11)	87	76.54	-0.34	6.78	35.65	0.0345
2.5	10.49(03)	18.39(03)	20.65(08)	96	72.56	-1.56	8.29	50.42	0.0573

U$_{corr}$=U/(NP-m), where m=number of species; NP=Number of experimental points; SD=standard deviation

3.1 Secondary formation functions

Secondary formation functions like number of moles of alkali consumed per mole of ligand (a) and average number of protons bound per mole of ligand (n$_H$) are useful to detect the number of equilibria. Plots of a with pH (Figure 3) have two and three plateaus, respectively, for Met and Cys indicating the existence of two and three equilibria. Plots of n$_H$ verses p^H (Figure -2) of different concentrations of the ligand should overlap if there is no formation of polymeric species.
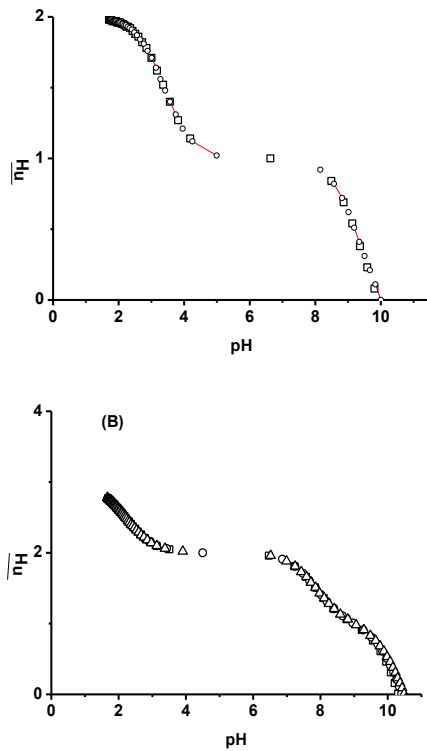
Fig 2: Plots of $\overline{n}_H$ versus pH of (A) Met and (B) Cys: ( ) 0.25, (○) 0.375, and (Δ) 0.50 mmol, respectively. in 1.5% w/v SDS- water mixture
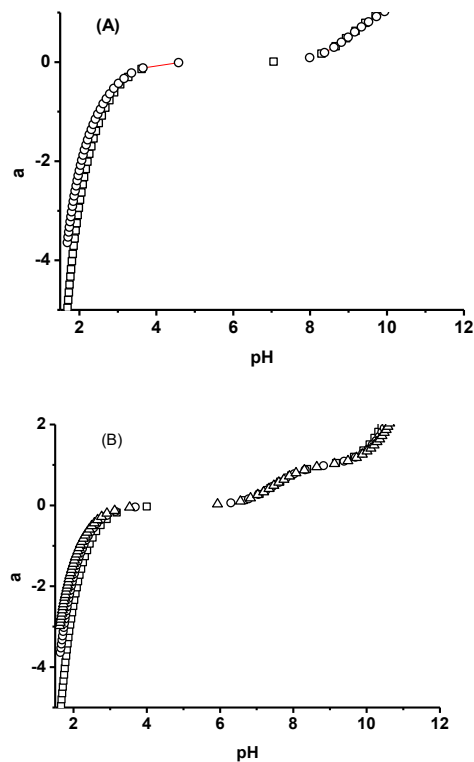

Fig 3: Variation of a with pH in 0.5 % w/v SDS–water mixture; of (A) Met and (B) Cys ( ) 0.25, (○) 0.375, and (Δ) 0.50 mmol, respectively.

3.2 Distribution diagrams

L-Methionine has two functional groups (amino and carboxyl) and both of them participate in the protonation equilibria and possess two protonation constants. On the other hand, L-Cysteine has three functional groups (amino, carboxyl, thioether) and they participate in the protonation equilibria and posses three protonation constants. The species distribution diagrams (Figure 4) occurred from the protonation constants show the existence of LH_2, LH, FL in the case of Met and LH_3, LH_2, LH, FL in the case of Cys in different pH ranges. The most predominant species in Met is LH form and for Cys it is LH_2 and the corresponding pH range is 1.5-10.5 and 1.5-10.0.
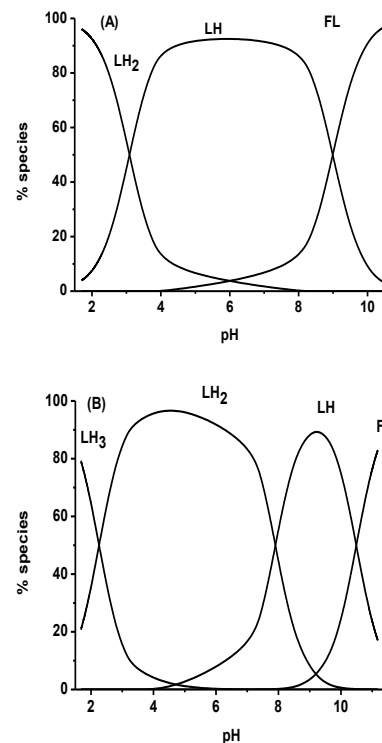

Fig4: Species distribution diagrams of (A) Met and (B) Cys in 2.5% w/v SDS-water mixture

3.3 Effect of Solvent

The variation of protonation constant or change in free energy with co-solvent

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content depends upon two factors, viz., electrostatic and non-electrostatic. Born's classical treatment holds good in accounting for the electrostatic contribution to the free energy change [25].According to this treatment, the energy of electrostatic interaction or the logarithm of step-wise protonation constant (log K) should vary linearly with the mole fraction of the medium.

The log K values in the present study are linearly increasing (Figure 5) with increasing molefraction of the medium in both the amino acids. Many workers were of the opinion that both electrostatic and non-electrostatic effects should be considered even in the case of simple acido-basic equilibria; one dominates the other, depending upon the nature of solute and solvent [26-28].
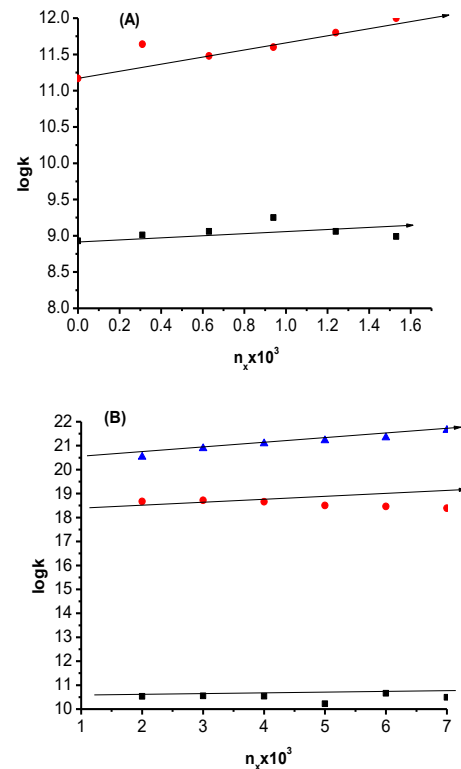

Figure 5: Variation of stepwise protonation constant (log K) with mole fraction of SDS -water mixture
(A) L- Met (□) $logK_1$, (Δ) $logK_2$, (B) L-Cys (□) $logK_1$, (○) $logK_2$, (Δ) log K_3

3.4 Effect of systematic errors on best fit model

In order to rely upon the best fit chemical models for critical evaluation and application, the effect of systematic errors in the concentration of ingredients like mineral acid, alkali and ligand on the magnitude of protonation constants was investigated and the order of ingredients due to incorporation of errors is alkali>ligand>acid. The results of the above investigations are given in Table 2.

Table 2: Effect of systematic errors in influential parameters on the protonation constants ofMet and Cys in 0.5% w/v CTAB-water mixture

Ingredient	%	log β_{mlh} (SD)		

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	Error	Met		Cys		
		11	12	11	12	13
	0	9.06(2)	12.62(04)	10.66(05)	18.46(07)	21.34(11)
Alkali	-5	9.56(3)	12.69(02)	10.88(07)	Rejected	21.76(04)
	-2	Rejected	12.98(06)	11.43(03)	19.05(02)	22.06(06)
	+2	9.34(23)	12.35(11)	11.54(32)	19.45(23)	Rejected
	+5	9.89(12)	12.88(34)	11.22(16)	rejected	21.98(19)
Acid	-5	9.35(14)	Rejected	11.95(23)	19.66(14)	21.45(09)
	-2	9.77(06)	12.88(14)	Rejected	18.76(15)	21.89(32)
	+2	9.45(12)	12.12(16)	11.63(17)	19.32(27)	21.98(34)
	+5	9.96(18)	12.67(28)	11.56(36)	19.67(18)	22.23(17)
Ligand	-5	8.95(23)	12.54(15)	10.32(18)	18.19(38)	20.96(16)
	-2	9.34(12)	12.60(15)	11.26(11)	18.96(16)	21.89(25)
	+2	9.22(16)	12.21(23)	11.45(33)	19.32(16)	21.96(18)
	+5	9.66(19)	12.76(28)	11.09(17)	19.25(23)	21.54(16)

pH range: 1.8-3.5   1.8-10.0   6.0-11.0
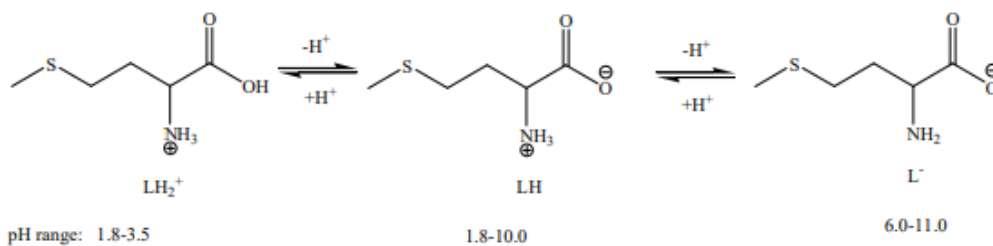
Protonation-deprotonation equilibria of L-methionine
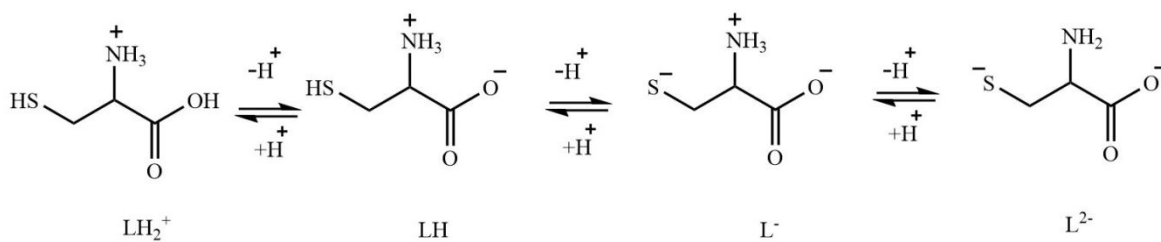
Protonation-deprotonation equilibria of L-cysteine

4. Conclusions:

- The protonation constants and number of equilibria could be determined from the secondary formation functions like average number of protons bound per mole of ligand n_H and number of moles of alkali consumed per mole of ligand

- The study of the effect of systematic errors in the ingredients indicated that the order of influence of the ingredient concentration on protonation constants is alkali>ligand>acid.
- The log K values of protonation constants increase linearly with increasing molefraction of SDS-water mixtures. This trend indicates the dominance of electrostatic forces over than non-electrostatic forces in the protonation-deprotonation equilibria.

References

[1]. G. N. Rao, K. G. Sudarsan: "Effect of Micelles on Speciation of Ternary Complexes of Nickel(II) with L-arginine and L-histidine". Chem. Spec. Bioavailab., 18, 71 (2006).

[2]. V. U. S. Sagar, G. HimaBindu, K. G. Sudarsan, G. N. Rao: "Speciation Studies of Binary Complexes of Nickel(II) with L-arginine and L-histidine in Micellar Medium". J. Indian Chem. Soc., 82,598 (2005).

[3]. K. V. Lavanya, G. N. Rao, M. Rajesh, M. S. Babu:"Micellar Effect on Protonation Equilibria of L-arginine and L-histidine". J. Indian Chem. Soc., 81, 384 (2004).

[4]. B. B. V. Sailaja, T. Kebede, G. N. Rao, M. S. P. Rao:" Effect of Surfactants on Protonation equilibria of Oxalic and Malonic Acids". J. Indian Chem. Soc., 79,155 (2002).

[5].Y.Triveni, B. B. V. Sailaja:"Protonation Equilibria of L-Methionine and L-Cysteine In Cationic Micellar Media".IJSRR 2019, 8(1), 2734-2744.

[6]. B.Simon, J.Span: A Study of Dye – Surfactant Interactions. Part 1." Effect of Chemical Structure of Acid Dyes and Surfactants on the Complex Formation". Dyes and Pigments, 36,1(1998).

[7]. J. C. Russell, U. P. Wild, D. G. Whitten: "The Heptanol Swollen Micelle: Fluorescence and Absorbance Probe Studies of Size and Solubilization Properties". J. Phys. Chem., 90, 1319 (1986).

[8]. D. Danino, Y. Talmon, H. Levy et al:" Branched Thread-like Micelles in an Aqueous Solution of a Trimeric Surfactant". Science, 269, 1420 (1995).

[9]. D. Danino, Y. Talmon, R. Zana:" Alkanediyl-alpha,omega-bis(dimethylalkylammonium bromide) Surfactants (Dimeric Surfactants). 5. Aggregation and Microstructure in Aqueous Solutions".Langmuir, 11, 1448 (1995).

[10]. R. Zana, Y. Talmon:"Dependence of Aggregate Morphology on Structure of Dimeric SurfactantsNature".362, 228 (1993).

[11].PiretJ,Lamontagne J,Bestman-Smith, J,Roy, S, Gourde, P,Desormeaux, A, Omar, R.F,Juhasz, J. & Bergeron, M.G. (2000)."In vitro and in vivo evaluations of sodium laurylsulfate and dextran sulfate as microbicides against herpes simplex and human immunodeficiency viruses". J. Clin. Microbiol.**38** (1): 110–19.

[12]. Lewis MA. "The effects of mixtures and other environmental modifying factors on the toxicities of surfactants to freshwater and marine life". Water Res. 1992;26(8):1013–23.

[13]. Warne MS, Schifko AD. "Toxicity of laundry detergent components to a freshwater

cladoceran and their contribution to detergent toxicity". Ecotoxicol Environ Saf.

1999;44:196–206.

[14]. Zheng YJ, Chen L, Chen YP, Huang R."Acute toxicity of sodium dodecyl sulfate

(SDS) on selected aquatic organisms.Nong Ye Huan Jing KeXueXueBao".

2006;25:496–8.

[15]. B. Regland, L. Abrahamsson, K.Blennow, B. Grenfeldt, C.G. Gotlfries, *J. Neural*

*Transm.***2004**, *111*, 631-640.

[16]. M. Noji, K. Saito, *Sulphur in plants*, A review **2003**,135–144.

[17] Maier T, Winterhalter C., "Microorganism with deregulated Cysteine metabolism,

useful for high level production of cysteine and its derivatives has increased activity of thecysb transcription Regulator". Germany, WO200127307-A **(2001)**

[18]. Sano K, Mrrsugi K. "Ezymatic production of L-cysteine from DL- 2-amino-thiazoline-

4-carboxylic acid by Pseudomonas.Thiazolinophilum: optimal conditions for enzyme

formation and enzymatic reaction". *Agric. Biol. Chem*. **42**, 2315 **(1978) .**

[19].Hee RO, Yeong J.J., Soo CS., " Continuous L-cysteine production using immobilized

cell reactors and product extractors". *Process Biochem*.32, 201 **(1997).**

[20]. Baker DH, Czarnecki-Maulden GL (June 1987). "Pharmacologic role of cysteine in

ameliorating or exacerbating mineral toxicities". J. Nutr. **117** (6): 1003–10.

[21]. K. V. Santhee Devi, B. Rama Raju, G. N. Rao, " Effect of dielectric constant on

protonationequlibria of L-dopa and 1, 10 - phenanthroline in dioxan-water mixtures", *ActaChim.Slov.*,**2010**, 57, 398.

[22]. R. S. Rao, A. Satyanarayana, P. V. K. Rao., "SOPHD: Simulation of pH Metric Data".

In: Proc. Summer Simulation Conference, 1984, p. 563.

[23]. Gans P., Sabatini A., Vacca A., Inorg. Chim.Acta 1976, 18, p237

[24]. M. P. Latha, V. M. Rao, T. S. Rao, G. N. Rao., " Determination of Protonation Constants of L-glutamic Acid and L-methionine in 1,2-propanediol-water Mixtures".

ActaChim.Slov., 54, 160 (2007)

[25].G. Gran, Anal. Chim.Acga. 1988, 206, 111-123.

[26] N. Padmaja, M. S. Babu, G. N. Rao, R. S. Rao, K. V. Ramana, Polyhedron,1990, 9,

2497 – 2506.

[27] G. N. Rao"Complex equilibria of some biologically important metal ions in aqua-

organic media", Ph. D. thesis, Andhra University, Visakhapatnam, India 1989.

[28] P. Gans, A. Sabatini, A. Vacca, Inorg. Chim.Acta 1976, 18, 237 – 239.