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EFFECT OF THE SEQUESTERING AGENTS ON THE LIGHT FASTNESS OF THE REACTIVE DYES

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Abstract— **One of the characteristic of sequestering agent is to reduce the hardness of water in order to make it fit for the use of in textile processing.**

Some of the sequestering agents have slightly adverse effect on the light fastness of reactive dyes; keeping in view this statement it is recommended that E.D.T.A and Sodium Hexa Meta phosphate may be widely used where there is non-availability of soft water which gives excellent results in pre-treatment and dyeing.

Using the E.D.T.A and Sodium hexa Meta phosphate with different concentration with Reactive dyes (i.e. Cibacron), the effect on light fastness has been observed which is recorded through research work by plotting the graphs and making tables

Key words— **Textile, sequestering, E.D.T.A, Sodium Hexa Meta phosphate etc.**

I. Introduction

Pakistan is majorly dependent on the textile sector. Textile industry exports worth 22 billion USD goods per annum and contributes around 54% of the total exports of the country. Textile and clothing industry comprises of 46% of the total manufacturing and provides the jobs 38% of the total manufacturing jobs of the country. Textile sector supports various allied industries, including banking, insurance, transportation, shipping, forwarding etc.

Unfortunately the quality-water found in our rivers but they have not sufficient amount of water to supply the textile industry, because of the huge amount of consumption of water for domestic purpose along with agriculture crop utilization, obviously we have to go for next option, which is underground water.

There are over 6000 small to large industrial units operating in the Karachi, most of the industries are located in five major industrial zones namely, Landhi industrial trading estate (LITE), Sindh Industrial trading estate (SITE), Korangi Industrial estate (KIA), west wharf industrial area and Hub industrial trade estate HITE, in addition to these industries also located in the F.B area and North Karachi Industrial Area NKIA.

A. Sources of Water Supply to Karachi City

There are two main sources of water supply to the Karachi city, which are given below;

1) Underground Water Supply

Groundwater resources in Karachi Division are limited. The aquifers close to the coastal belt are mostly saline and unusable for domestic and industrial purposes. The aquifers near the Hub River bed are well developed and are source of water for agriculture and other domestic purposes. Generally the aquifers in Karachi are estimated at depths of 50 to 100 meters. The aquifers in un-consolidated sediments are very limited and there are little chances of their development. These can be considered as localized and limited sources of potable water. The chances of developing confined and open aquifers in the stratified rocks are bright and most prospective. The most promising stratified rocks appear sand stone and sandy limestone units of the Gaj Formation and sand stone units of Nari formation. The sandstones units of Manchar formation and lime stone units of Laki formation can also be considered and significant.

- These aquifers are encountered in general between 10-167 meters depth, in all the four formations (Laki formation, Gaj formation, Nari formation and Manchar formation). Apart from the domestic purpose, ground water is also being utilized by the industrial and commercial purposes, after the treatment. Ground water is highly saline in nature, contains have very high amount of TDS.

Data for the quantity of ground water being utilized is not available

2) Surface water Supply

The Indus River is about 120 km to the east of Karachi city. The Hub River is a perennial stream that originates in Baluchistan and marks the boundary between Karachi Division and Baluchistan is also the sources of fresh water in Karachi. The Lyari and Malir Rivers that passes through the city do not have any natural flow, except during the monsoons. The Lyari River falls in Kemari Creek and Malir River falls in Gizri Creek. Malir River is ephemeral and is constituted from two major tributaries, i.e. Mol and Khadeji as well as some minor tributaries. Khadeji is a perennial stream that originates at Khadeji falls and gains flow as it travels across the Malir Basin. The Malir and Khadeji River basins include dry hill torrents and flow depends upon precipitation during rains. The breakup of water supply sources is given in following table no.01

S.No	Source	Quantity (MGD)
01	Greater Karachi	280
02	Gharo	28
03	KII	100
04	Additional	40
05	KIII	100
06	Steel Mill	22
07	PQA	08
09	Hub Dam	90
10	Dumlotee Wells	02
	Total	670

Table 1: Details of Water Supply Sources to Karachi
Source: www.kwsb.gos.pk

B. Water Supply Scenario

- The present supply to Karachi from Indus and Hub source is approx 650MGD (2925 ml/day).
- The per capita water demand @ 54 GPCD for population 20 Million is estimated about 1080 MGD.
- The current short fall is anticipated as 430 MGD.
- First Phase of K-IV Project may take up to 5 years to complete i.e. by the year 2015.
- By the year 2015, projected population of Karachi will be 23 Million and @ 54 gallons per capita per day, the demand of water shall be 1242 MGD.
- By the year 2015 there will be a short fall of 600 MGD (2700 ml/day) water.
- 100 MGD (450 ml/day) additional water is required after every 5 years to bridge the gap of demand and supply.

"Effect of the sequestering agents on the light fastness of the reactive dyes"

This research work have been effectively conducted to achieve the results of the Light fastness of the reactive dyes, we have obtain the dyes of Cibacron (Swiss speciality chemicals Pvt Ltd) having the brand names Cibacron-P and Cibacron-C, we were used two different sequestering agents namely Ethylene diamine tetra acetic acid (EDTA), sodium hexa meta phosphate (S.H.M.P).

In our research work above sequestering agent were used with dyes obtained from Ciba (Swiss Speciality Chemicals Pvt Ltd Karachi. It was observed that EDT A and sodium hexa Meta phosphate which has given the remarkable performance in relation to the dyeing properties such as Light fastness. The total experimental trails were performed to observe the effect of sequestering agent on the Light fastness. These all trails are performed in distilled water, because whatever the amount of sequestering agent is used in the dye it react with only the dyes so that we have taken the distilled water in standard as well as trails.

Detailed information regarding chemistry of reactive dyes their systems and chemistry of sequestering agent and classification are described below.

II. Sequestering Agent

A. Introduction:

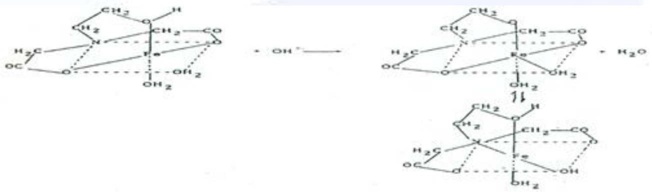
Sequestering agent is also referred to as a chelating agent, are the products which deactivate metals by tying up them or denying metals ions freedom to move about in solution.

In coloration trace-metal ions can react with certain dyes, giving rise to precipitation, discoloration, un-level dyeing and or reduced fastness properties. Such problems can be solved using chemicals that react preferentially with metal ion; effectively preventing it from interfering with the mainstream reaction or process such chemicals are known as sequestering agents. The processing water is the most obvious source of such extraneous metal ions, but other potential should not be overlooked. For example trace metal be dissolved form the surface of the machinery and pipe fittings. The substrate may already contain such metals, as may also any chemical (caustic soda) or dyes used. Hence these problems cannot always be avoided simply by ensuring the supply of suitable water- indeed, the over-zealous treatment of water can actually lead to the presence of trouble some aluminum ions that were not originally present!

The efficiency of sequestering agent must be optimized for a particular set of conditions especially to the pH of the system and to whether broad spectrum or specific sequestering is required.

Finally, in some circumstances problem can arise in the use of certain sequestering agent that can remove the metal from a dye, with the subsequent changes in shade or fastness properties particularly light fastness, reactive and direct dyes which contains metals (blues and navy of the reactive) and Metal complex acid dyes and mordant dyes are obviously vulnerable, keeping in view the above statement preference may be given to those sequestering which does not affect the depth of shade and light fastness. Working mechanism of sequestering agents:

The Sequestering agent work by a mechanism of complex formation, often in the form of chelation. Chelation depends upon whether or not the metal is ionized is in solution. If iron is present in the form of iron oxide it cannot be chelated because it is in a non-ionisable form and it is not precipitated from the bath. On the other hand iron present as ferrous sulphate (FeS04) can be chelated. As shown in following figure 01 of chelated metal.



Structure 1

A Sequestering agent contains substituent suitably located to form one or more chelate rings by electron donation to the metal ion, resulting complex remaining soluble in water under the condition of processing. The most useful donating atoms are nitrogen as found in amines or substituted amines and oxygen in the form of carboxyl phosphate or ionize hydroxy groups. As in the form of dye metal chelates (blue and navy dyes of the reactive are based on metals) at least two electron donating atoms in the sequestering agent structure must be arranged so that a stable ring can be formed with a metal ion the highest stability resulting from five and six membered rings. However pH of the system is very important.

The inorganic polyphosphate tend to be most efficient under slightly acid conditions, whilst the aminopolycarboxylates generally work best under neutral or alkaline conditions although they still show some usefulness and are used at pH values of around 4-5

B. Classification of Sequestring Agents:

There are three classes of sequestering agents which are given as under;

- Aminopolycarboxylates
- Phosphates (mainly inorganic)

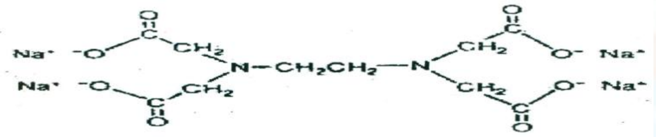
1) Aminopolycarboxylates:

The aminopolycarboxylates are the powerful chelating agents; they are mostly used in dyeing and pre-treatment. The aminopolycarboxylates acts as sequestering agent by forming structure in which each metal ion is chelated into one or more five membered rings. It is often assumed that one molecule of sequestering agent react with one ion of the metal.

Ethylene di amine tetra acetic acid (EDTA) is belongs to Aminopolycarboxylates chelating group.

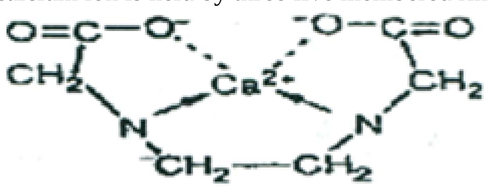
a) Ethylene di amine tetra acetic acid (EDTA):

A chemical that is used to remove all traces of magnesium and calcium and Fe, ions from a solution because it binds tightly to them, in order to control unwanted side reactions with these metals during a process EDTA is commonly used in pre-treatment and dyeing, such products are solid either as free acids or as sodium salts, EDT A is more usually available in open market as the di or tetra sodium salt as shown in structure.



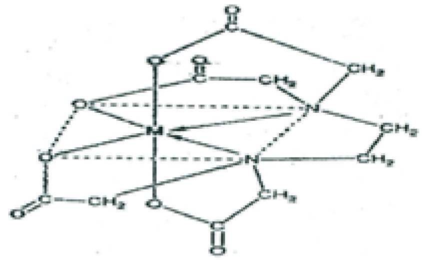
Structure 2

As we know that the reactive dyes are based on sodium sulphonate which is a salt and some of them are based on the metals such as iron copper etc, the nature of complexes actually formed, however, may depend on the other factors such as the pH of the medium. It is difficult to represent such structure in detail, particularly as water of solvation is usually involved. It is convenient to adopted a simplified representation, omitting the water of solvation, as for the EDTA -calcium shown in structure 3.3 in. which arrows represents coordination bonds and the calcium ion is held by three five membered rings.



Structure 3

A more elaborate representation of an EDTA-metal complex, which gives some indication of the three-dimensional aspects of the structure, shows a complex of five five-membered rings as shown in structure.



Structure 4

2) Phosphates (mainly inorganic)

Phosphates are the effective sequestering agents, under appropriate conditions, they work very efficiently, they are sensitive to pH and temperature. Sodium hexa Meta phosphate is belong to this type of chelating group.

a) Sodium hexa Meta phosphate [Na2 (Na4P6O18)]

Sodium hexa meta phosphate is used for water softening, it can chelate Ca, Mg, and metals easily at normal temperature, these functions by withdrawing the troublesome metal cation into an innocuous and water soluble complex anion by a process of ion exchange, which is shown in equation below;

$$Na_2\,Na_4P_6O_{18} + 2Ca^{2+} \rightleftharpoons Na_2\,(Ca\,P_6O_{18}) + 4Na^{+}$$

The disadvantage of sodium hexa Meta phosphate is that at temperatures used in many textile processes, just like scouring bleaching and dyeing, 100°C or higher they can be hydrolyzed into simpler phosphates that cannot retain the metal atom in the sequestered form.

For example disodium, dicalcium hexa Meta phosphate hydrolysed on prolonged boiling to yield the insoluble calcium orthophosphate.

III. Reactive Dyes

Introduction

Reactive dyes offer bright shades and good properties combined with relatively easy application at a moderate cost. These attribute have enabled them to gain their market share chiefly at the expense of azoic dyes. They have achieved more limited market penetration against Vats, which offers excellent fastness at a high price and against directs, which generally offers cheapness and easy application but duller shades and only poor fastness.

Reactive dyes as a group are not sensitive to hard water. Nevertheless, the alkali is used in most reactive dyeing processes may precipitate calcium or magnesium salts on the substrate, to cause the problems in later processes. Ideally soft water with a pH not greater than 7 is preferred. Where the use of hard water is unavoidable a sodium hexa meta phosphate sequestering agent may be used in a minimum amount needed to overcome the hardness, since the excessive quantities may bring about a significant reduction in dye yield. Organic sequestering agent of the Ethylene diamine tetra acetic acid (EDTA), type are the generally best avoided because they often result in color changes and reduced light fastness, although they can occasionally be used successfully in minimal quantities.

Chemistry of Reactive Dyes

Covalent bonding of the cellulosic fibers to the reactive system of the dye is an important feature depending on the reactive system attached to chromophore.

1. Bridging Group

The chromogen and the reactive group are joined together by a bridging group. The presence of a bridging group is technically important, since the nature of the group can influence the properties of dyes. The bridging group may affect the reactivity of some reactive groups either increasing or reducing their reactivity.

2. Solubilizing groups

Reactive dyes for cotton and protein fibre generally contain solubilizing groups such as the sulphonate group. The exact number of sulphonate groups can be chosen to enhance the dye's suitability for a particular dyeing procedure, the structure of reactive dyes consists of two parts; the chromogen and the reactive system. The dye chromophore could be azo, anthraquinone, Phthalocyanine or other.

3. Reactive system

Many reactive groups are employed in commercial dyes. Cyanuric chloride derivatives are of particular significance due to the specificity of the reactivity of its chlorine atoms. Cyanuric chloride is a very reactive compound based on the triazine ring. The canonical form of this compound results in a buildup of a positive charge on the ring atoms; which makes the three chlorine atoms labile and readily susceptible to gradual nucleophilic displacement.

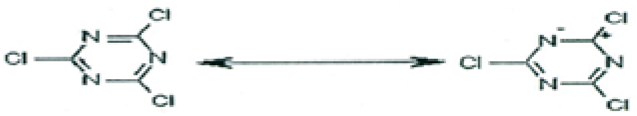


Figure: 1 (Resonance canonical structure of cyanuric chloride)

If the attacking nucleophile is a water-soluble amine then the reaction can easily be carried out in a stepwise manner according to temperature. Thus the first chlorine atom of cyanuric chloride can be displaced by an amine nucleophile at 0-5 °C, the second at 35- 40°C and third at 80-85 °Cl. The Procion MX dyes contain the dichlorotriazinyl reactive system and are susceptible to attack at 35-40 °C by a nucleophile Monochloro-s-triazine dyes are of lower reactivity and are especially useful for printing and low Liquor dyeing. Thus an amine or an alkoxide group displaces one of the chlorine atoms.

Monochloro-s-triazine dyes react with cellulose in exactly the same manner as the dichloro dyes; expect that higher temperature and pH values are required.

A. Azo Reactive Dyes

Azo reactive dyes are the most popular because of their economical synthesis and ease of application. Wise selection of coupling components and reactive groups can result in various hues of azo reactive dyes.

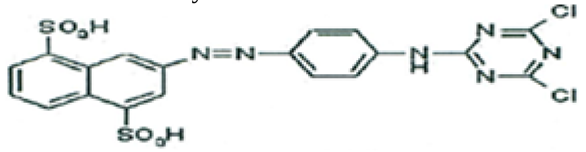


Figure: 2 (CI Reactive Yellow)

The most commonly used coupling components are sulphonated aminonaphthol derivatives, which provide a range of hues from. orange through black.

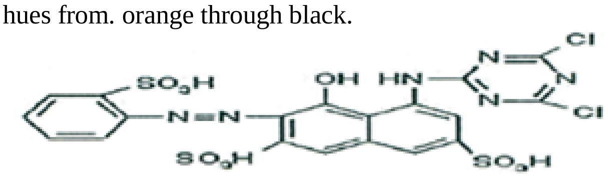


Figure: 3 (CI Reactive Red)

The hues like brown can be produced in diazo molecule by using one, two or often three napthylamine molecules.

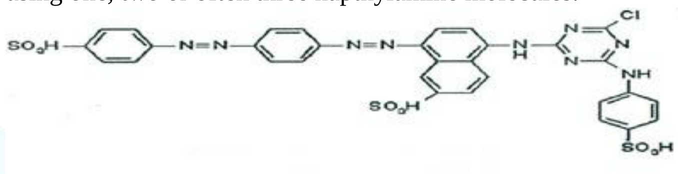


Figure: 4 (CI Reactive Brown)

B. Anthraquinone Reactive Dyes

Anthraquinone reactive dyes are the second most important range of reactive dyes. Most of these types are derived from Bromamine acid (l-amino-4-bromoanthraquinone-2-Sulphonic acid) and by variation of the substituent present a wide range of colors can be obtained. e.g.

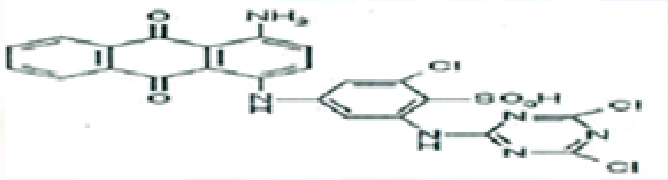


Figure: 5 (CI Reactive Blue)

C. Poly Functional Reactive Dyes

As their name implies, these dyes carry two or more reactive groups in a single dye molecule. They provide excellent dyeing efficiency and good overall fastness properties. Poly functional dyes are not systematically better; only the right combination of reactive groups makes them superior to conventional mono functional reactive dyes9. Dyes having more than one reactive group have a greater chance of reaction with the fibre.

The first successful range of hetro bifunctional dyes was developed by the Sumitomo and was marketed as Sumifix Supra dyes. The dyes contain Monochloro triazine as the first reactive group and B-sulphatoethylsulphone as the second functional group.

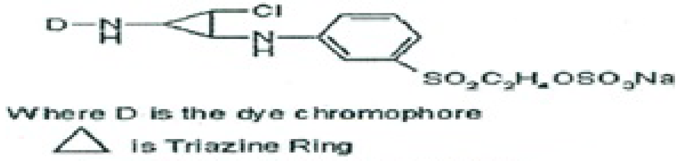


Figure: 6 (Sumifix Supra type dyes)

Reactive groups of differing reactivity means that the dyeing are less sensitive to temperature, so treatment can be carried out at a wider range of temperature in less efficient machinery.

The homo bifunctional dyes carry two or more reactive groups of the same kind. The hetero-bifunctional reactive dyes are widely used for reactive dyeing these days and have certain advantages over homo bifunctional reactive dyes. Two reactive groups of different reactivity offer separate advantages.

D. Chromosphere in Reactive Dyes

The chromogen is the colored part of a reactive dye molecule. In practice it can be azo (monoazo or disazo), anthraquinone, Phthalocyanine or triphenodioxazine, provided it has the necessary substantively for the fibre. However the chromogens in use are frequently common to various ranges and only the reactive system varies.

E. Mechanism of Reactive Dyeing

The cellulose anion is a nucleophile, which can take part in addition and substitution reaction.

1) Nucleophilic Substitution Reaction

Triazinyl reactive dyes undergo reaction with cellulose substrates via this mechanism. The hydroxyl a1ion of cellulose attacks at the electron deficient carbons of the heterocyclic ring.

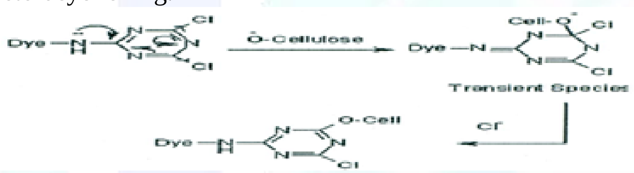


Figure: 7 (Substitution mechanisms for a dichloro-s-triazine dye)

2) Nucleophilic addition mechanism

Reactive dyes based on B-sulphatoethylsulphone undergo eliminate to the vinylsulphone form with then react via an addition mechanism.

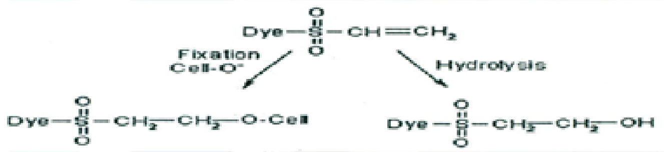


Figure: 8 (Hydrolysis and fixation reaction of vinyl sulphone dyes)

The carbon-carbon double bond is polarized by the powerfully electron attracting sulphone group. The polarizing effect results in a positive charge to the end carbon atom and allowing nucleophilic addition of ionized cellulose to occur. The electron deficient Sq2 group activates the Ethylenic carbon atom and acts as a bridge between the dye chromophore and the reactive group.

Cibacron-C Dyes:

Cibacron-C is based on bifunctional groups which are vinyl sulphone and Flouro triazine groups, these dyes are bi-reactive and have high fixation rate and low hydrolysis at about 82-92 % and fixation rate at 8-18 % hydrolysis in pad thermosol process. They are highly soluble in water at room temperature there is no need of raising the temperature for dye solublization. They need low amount of alkali for fixation. Due to Flouro triazine group they have medium to high reactivity. These dyes are based on metal complex and sensitive to some sequestering agent. There are three basic shades of Cibacron-C dyes are selected for our research work which is:

- Cibacron Blue C-R
- Cibacron Yellow C-R0I
- Cibacron Red C-2BL

Cibacron-P Dyes:

Cibacron-P dyes are based on mono cholorotriazine MCT group, these are mono reactive dyes they are also easily soluble in water they need high amount of alkali as compare to the Cibacron-C dyes they can be applied on high temperatures, used easily in pad thermosol process. There are three basic shades of Cibacron-P dyes are selected research work which are:

- Cibacron Blue P-B
- Cibacron Yellow P-2RN
- Cibacron Red P-4B

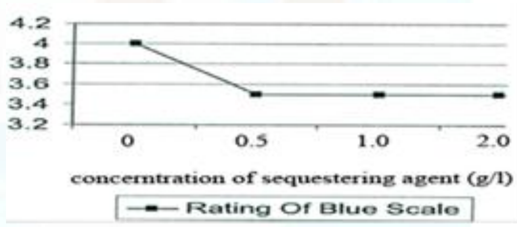
IV. RESULTS AND DISCUSSIONS

As a result of research work carried out by pad dry cure process, numerous results and observations are obtained, which is briefly explained below. The results are obtained through the ISO (B02) method of light fastness. For both sequestering agent and dye, the data is collected in this manner and described in a tabular form followed by their graphical representation. Finally, all the data is surnrnarised in a comparison graph, to decipher the impact of sequestering agent on light fastness.

Cibacron Blue P-B with EDT A

Code No	Conc: of Sequestering agent	Rating of Blue Scale
SCPBED 0	0 g/l	4.0
CPBED 0.5	0.5 g/l	3.5
CPBED 1.0	1.0 g/l	3.5
CPBED 2.0	2.0 g/l	3.5

Table 1



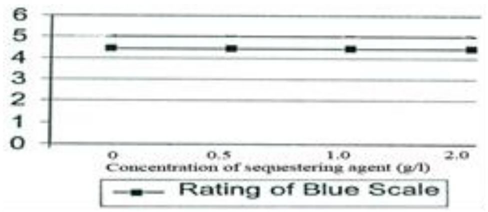
Graph 1

It is evident from the data mentioned in the table and graph no: 1 that loss in rating of blue scale with the increase in the amount of EDTA.

Cibacron Yellow P-2RN with EDT A

Code No	Conc: of Sequestering agent	Rating of Blue Scale
SCPYED 0	0 g/l	4.5
CPYED 0.5	0.5 g/l	4.5
CPYED 1.0	1.0 g/l	4.5
CPYED 2.0	2.0 g/l	4.5

Table 2



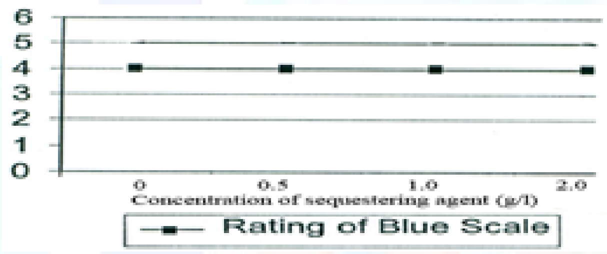
Graph 2

It is evident from the data mentioned in the table and graphs no. 2 that there is no change in the rating of blue scale with the increase in the amount of EDT A.

Cibacron Red P-4B with EDTA

Code No	Cone: of Sequestering agent	Rating of Blue Scale
SCPRED 0	0 g/l	4.0
CPRED 0.5	0.5 g/l	4.0
CPRED 1.0	1.0 g/l	4.0
CPRED 2.0	2.0 g/l	4.0

Table 3



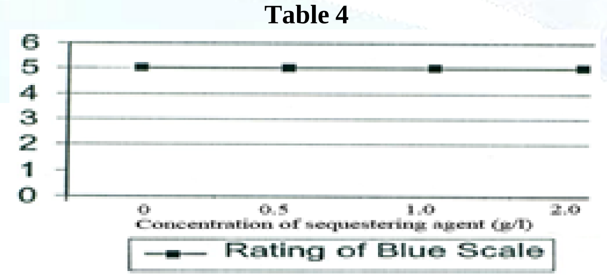
Graph 3

It is evident from the data mentioned in the table and graphs no.3 that there is no change in the rating of blue scale with the increase in the amount of EDT A.

Cibacron Blue C-R with EDTA

Code No	Cone: of Sequestering agent	Rating of Blue Scale
SCCBED 0	0 g/l	5.0
CCBED 0.5	0.5 g/l	5.0
CCBED 1.0	1.0 g/l	5.0
CCBED 2.0	2.0 g/l	5.0

Table 4



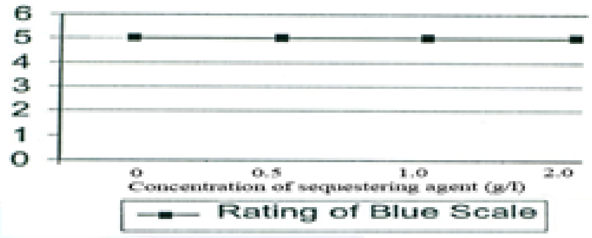
Graph 4

It is evident from the data mentioned in the table and graph no.4 that there is no change in the rating of blue scale.

Cibacron Yellow C-R01 with EDTA

Code No	Cone: of Sequestering agent	Rating of Blue Scale
SCPYED 0	0 g/l	5.0
CCYED 0.5	0.5 g/l	5.0
CCYED 1.0	1.0 g/l	5.0
CCYED 2.0	2.0 g/l	5.0

Table 5



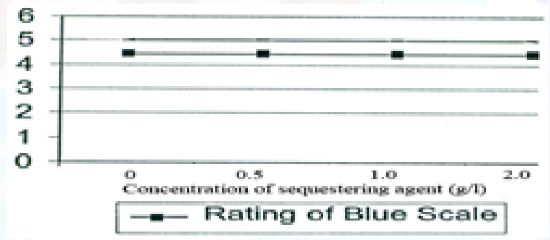
Graph 5

It is evident from the data mentioned in the table and graphs no. 5 that there is no change in the rating of blue scale with the increase in the amount of EDT A.

Cibacron Red C-2BL with EDT A

Code No	Cone: of Sequestering agent	Rating of Blue Scale
SCPRED 0	0 g/l	4.5
CCRED 0.5	0.5 g/l	4.5
CCRED 1.0	1.0 g/l	4.5
CCRED 2.0	2.0 g/l	4.5

Table 6



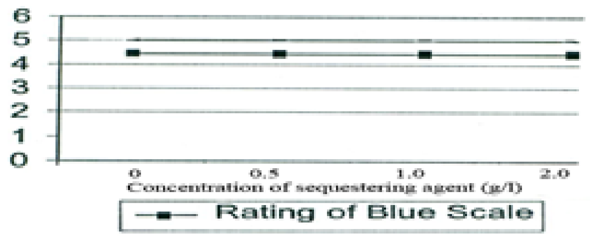
Graoh 6

It is evident from the data mentioned in the table and graphs no. 6 that there is no change in the rating of blue scale with the increase in the amount of EDTA.

Cibacron Blue P-B with Sodium Hexa Meta Phosphate

Code No	Cone: of Sequestering agent	Rating of Blue Scale
SCPBSO 0	0 g/l	4.5
CPBSO 0.5	0.5 g/l	4.5
CPBSO 1.0	1.0 g/l	4.5
CPBSO 2.0	2.0 g/l	4.5

Table 7



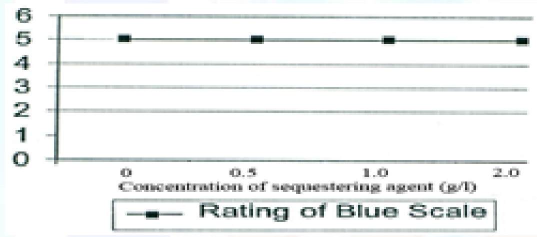
Graph 7

It is clearly shown from the data mentioned in the table and graph no. 7 at there is no change in the rating of blue scale with the increase in the amount of Sodium Hexa Meta Phosphate.

Cibacron Yellow P-2RN with Sodium Hexa Meta Phosphate

Code No	Cone: of Sequestering agent	Rating of Blue Scale
SCPYSO 0	0 g/l	5.0
CPYSO 0.5	0.5 g/l	5.0
CPYSO 1.0	1.0 g/l	5.0
CPYSO 2.0	2.0 g/l	5.0

Table 8



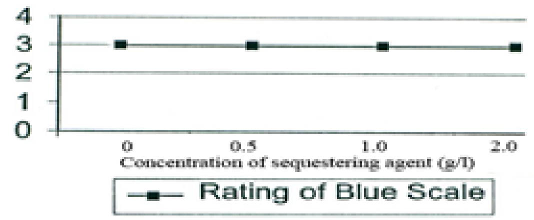
Graph 8

It is clearly shown from the data mentioned in the table and graphs no. 8 that there is no change in the rating of blue scale with the increase in the amount of Sodium Hexa Meta Phosphate.

Cibacron Red P-4B with Sodium Hexa Meta Phosphate

Code No	Cone: of Sequestering agent	Rating of Blue Scale
SCPRSO 0	0 g/l	3.0
CPRSO 0.5	0.5 g/l	3.0
CPRS0 1.0	1.0 g/l	3.0
CPRSO 2.0	2.0 g/l	3.0

Table 9



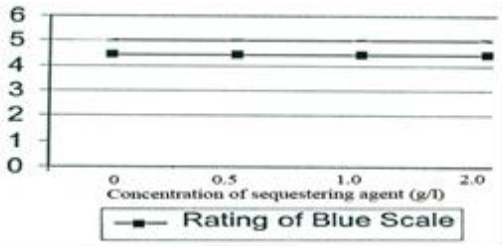
Graph 9

It is clearly shown from the data mentioned in the table and graph no. 9 that there is no change in the rating of blue scale with the increase in the amount of Sodium Hexa Meta Phosphate.

Cibacron Blue C-R with Sodium Hexa Meta Phosphate

Code No	Cone: of Sequestering agent	Rating of Blue Scale
SCCBSO 0	0 g/l	4.5
CCBSO 0.5	0.5 g/l	4.5
CCBSO 1.0	1.0 g/l	4.5
CCBSO 2.0	2.0 g/l	4.5

Table 10



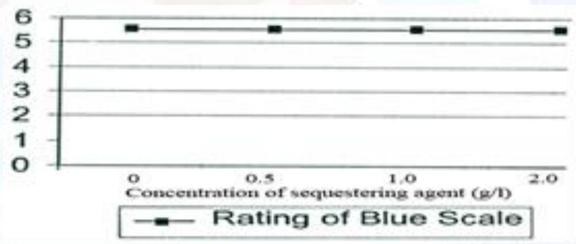
Graph 10

It is clearly shown from the data mentioned in the table and graph no. 10 that there is no change in the rating of blue scale with the increase in the amount of Sodium Hexa Meta Phosphate.

Cibacron Yellow C-R01 with Sodium Hexa Meta Phosphate

Code No	Cone: of Sequestering agent	Rating of Blue Scale
SCCYSO 0	0 g/l	5.5
CCYSO 0.5	0.5 g/l	5.5
CCYSO 1.0	1.0 g/l	5.5
CCYSO 2.0	2.0 g/l	5.5

Table 11



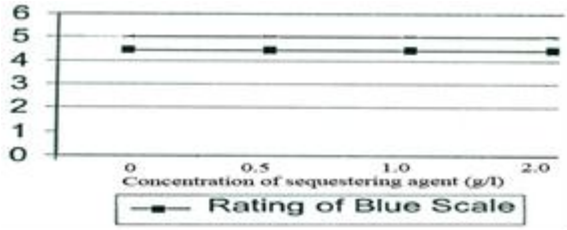
Graph 11

It is clearly shown from the data mentioned in the table and graph no. 11 that there is no change in the rating of blue scale with the increase in the amount of Sodium Hexa Meta phosphate.

Cibacron Red C-2BL with Sodium Hexa Meta Phosphate

Code No	Cone: of Sequestering agent	Rating of Blue Scale
SCCRSO 0	0 g/l	4.5
CCRSO 0.5	0.5 g/l	4.5
CCRS0 1.0	1.0 g/l	4.5
CCRSO 2.0	2.0 g/l	4.5

Table 12

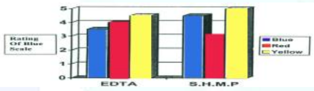


Graph 12

It is clearly shown from the data mentioned in the table and graph no. 12 that there is no change in the rating of blue scale with the increase in the amount of Sodium Hexa Meta Phosphate.

V. Comparison Graph for Sequestering Agent

Graph no. 01

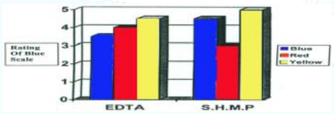


On the 0.5 g/1 Cone: comparing among the sequestering agent by using Cibacron-P Dyes It is clearly viewed from the comparison graph no. 01 that the optimum blue scale rating is obtained for yellow shade when compared with red and blue shades during addition of EDT A. It is apparent from the comparison graph no.01 that the optimum blue scale rating is obtained for yellow shade when compared with red and blue shades, the rating of blue scale for red shade is lowest when sodium hexa Meta phosphate is used as a sequestering agent in dye liquor.

Graph no.02

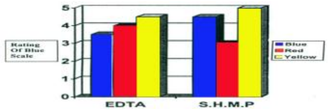
On the 1.0 g/1 Cone: comparing among the sequestering agent by using Cibacron-P Dyes It is clearly viewed from the comparison graph no. 02 that the optimum blue scale rating is obtained for yellow shade when compared with red and blue shades during application of EDTA. It is apparent from the comparison graph no.02 that the optimum blue scale rating is obtained for yellow shade when compared with red and blue shades, the rating of blue scale for red shade is lowest when sodium hexa Meta phosphate is used as a sequestering agent in dye liquor.

Graph no.03



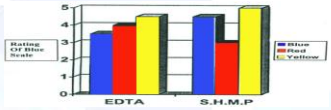
On the 2.0 g/1 Cone: comparing among the sequestering agent by using Cibacron-P Dyes It is clearly viewed from the comparison graph no.03 that the optimum blue scale rating is obtained for yellow shade when compared with red and blue shades during application of EDTA. It is apparent from the comparison graph no.03 that the optimum blue scale rating is obtained for yellow shade when compared with red and blue shades, the rating of blue scale for red shade is lowest when sodium hexa Meta phosphate is used as a sequestering agent in dye liquor.

Graph no.04



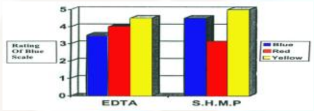
On the 0.5 g/1 Cone: comparing among the sequestering agent by using Cibacron-C Dyes It is clearly viewed from the comparison graph no.04 that the optimum blue scale rating is obtained for yellow and blue shades when compared with red shade during application of EDTA. It is apparent from the above comparison graph no. 04 that the optimum blue scale rating is obtained for yellow and blue shades when compared with red shade, the rating of blue scale for red shade is lowest when sodium hexa Meta phosphate is used as a sequestering agent in dye liquor.

Graph no.05



On the 1.0 g/l Cone: comparing among the sequestering agent by using Cibacron- Dyes It is clearly viewed from the comparison graph no.05 that the optimum blue scale rating is obtained for yellow and red shades when compared with blue shade during application of EDTA. It is apparent from the comparison graph no.05 that the optimum blue scale rating is obtained for yellow shade when compared with red and blue shades, the rating of blue scale for red and blue shades is lowest when sodium hexa Meta phosphate is used in a dye liquor.

Graph no.06



On the 2.0 g/I comparing among the sequestering agent by using Cibacron-C Dyes It is clearly viewed from the comparison graph no.06 that the optimum blue scale rating is obtained for yellow and red shades when compared with blue shade during application of EDT A. It is apparent from the comparison graph no.06 that the optimum blue scale rating is obtained for yellow and blue shades when compared with red and blue shades, the rating of blue scale for red and blue shades is lowest when sodium hexa Meta phosphate is used as a sequestering agent in dye liquor.

VI. Conclusion

From above research work it has been observed that EDTA and Sodium Hexa Meta Phosphate does not affects the shade of the Reactive dyes further summery of the results is given below;

- EDT A does not affect the Cibacron-C dyes but it slightly affects to the Cibacron-P dyes.
- Sodium Hexa Meta Phosphate affects the shade of the both dyes Cibacron-P and Cibacron-C.

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