Final Exam of First Semester 2016/2017

Course: technology of dyeing Third year student Textile Printing Dept.
Code: 3111 **Time:** 120 min. **Full mark:** (90)

First Question: (30 points)

I. Put (T) for true and (F) for false answers in the following statements.
II. Correct the false ones.

1. Under alkali conditions, the cellulose-OH groups are encouraged to protonate to give cellulose-O^- groups. (F)

*Under alkali conditions, the cellulose-OH groups are encouraged to **deprotonate** to give cellulose-O^- groups.*

2. Nucleophilic addition is facilitated by the electron withdrawing properties of the aromatic nitrogens, and the chlorine attached to the aromatic ring. (F)

***Nucleophilic substitution** is facilitated by the electron withdrawing properties of the aromatic nitrogens, and the chlorine attached to the aromatic ring.*

3. The nucleophilic addition occurs with alkenes. (T)
4. Polyviny1 alcohol may be regarded as similar to cellulose with regard to chemical activity. (T)
5. The mono-chlorotriazinyl dyes are less reactive than the di-chlorotriazinyl dyes. (T)
6. Solutions of reactive dyes can be stored for any length of time without serious loss of potential colour value. (F)

*Solutions of reactive dyes **cannot** be stored for any length of time without serious loss of potential colour value.*

7. Cellulose has some affinity for the hydrolysed dye, which, having lost its chlorine atoms and has not entered into chemical combination. (T)
8. Reactive dyes with poor affinity cannot be exhausted satisfactorily without greatly increased additions of salt. (T)
9. The use of two reactive groups in a dye molecule results in lower fixation efficiencies. (F)

*The use of two reactive groups in a dye molecule results in **higher** fixation efficiencies.*

10. Both the total amount of acid dye adsorbed and the rate of exhaustion influenced by the amount of acid. (T)
11. The higher the molecular weight of an acid dye, the greater would be the tendency for it to form molecular dispersion. (F)

The higher the molecular weight of an acid dye, the greater would be the tendency for it to form ***molecular aggregates***.

12. Owing to the colloidal aggregate of migrating class (C) acid dyes, they pass into and out of the fibre easily at any temperature. (F)

Owing to the colloidal aggregate of migrating class (C) acid dyes, they ***don't pass*** *into and out of the fibre easily at any temperature.*

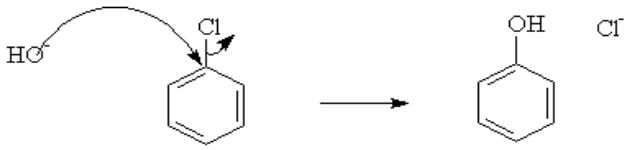
13. When acid dyes molecule can present a comparatively flat surface to the fiber its probable that there is a great opportunity for ionic bonds and Vander walls forces to come into play. (T)
14. Migration phenomenon means that dye molecules attached to the fiber are constantly becoming unattached and being refixed on another site. (T)
15. Class C acid dyes have a marked tendency towards level dyeing, and possess good wet-fastness. (F)

Class C acid dyes have a marked tendency towards ***unlevel dyeing****, and possess good wet-fastness.*

Second Question: (30 points)

Choose the right answer in the following questions:

1. ***In reactive dyes, the water solubilising group has the expected effect of:***
   a. Improving the substantivity.
   b. Improving the reactivity.
   c. ***Improving the solubility.***
2. ***According to The blew groups can be added to the aromatic ring:***



   a. ***To encourage nucloephilic substitution,and the groups added will decrease the electron density at a position and facilitate attack.***
   b. To limit nucloephilic substitution,and the groups added will increase the electron density at a position and facilitate attack.

c. To encourage nucloephilic substitution,and the groups added will decrease the electron density at a position and difficult attack.

3. *In reactive dyes, the strength of the …….. improve the wet fastness.*

a. Hydrogen bond.

b. ***Covalent bond.***

c. Ionic bond

4. *……is removing dyes from colored fabric.*

a. Migration

b. Hydrolysis

c. ***Stripping***

5. *Reactive dyes containing two different reactive groups is called:*

a. ***Hetero-bifunctional.***

b. Homo-bifunctional.

c. Polyfunctional.

6. *In ……only the depth of shade is changed*

a. ***Back stripping***

b. Destructive stripping.

c. Non- destructive stripping.

7. *Most of the acid dyes are:*

a. Sulphonic acid salts, but there are a few containing hydroxyl groups.

b.***Sulphonic acid salts, but there are a few containing carboxyl groups.***

c. Sulphonic acid salts, but there are a few containing azo groups.

8. *Acid dyes which are closely related structurally to direct cotton colors containing:*

a. Azo and nitro groups

b. ***Azo and sulphonic groups.***

c. Azo and hydroxyl groups.

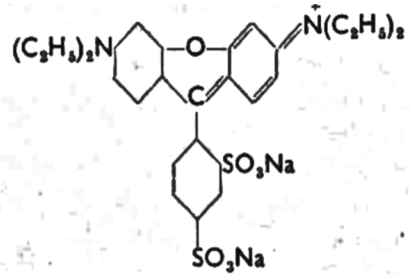
9. *The effect of electrolyte in acid dyeing is only apparent when dyeing at low pH values, and in neutral solutions:*

a. The presence of electrolytes accelerates adsorption.

b. The presence of electrolytes retards adsorption.

c. The presence of electrolytes has no effect adsorption.

10. The following structure represent an acid dye of group



a. Derivatives of triphenyl methane.
b. ***Derivatives of Xanthene.***
c. Derivatives of pyrazolone.

11. ***Dyes requiring strong acid, such as sulphuric acid are classifies as:***
a. ***Class 1***
b. Class 2
c. Class 3

12. ***Acid dyes, which colloidally dispersed at low temperatures but in molecular dispersion at higher temperatures Possess:***
a. ***Good levelling properties at high temperatures***
b. Good d levelling properties at moderate temperatures
c. Good levelling properties at low temperatures.

13. ***Acid dyes are invariably manufactured as sodium salts because***
a. ***The free dye acids are more difficult to isolate and they are hygroscopic***
b. The free dye acids are less difficult to isolate and they are hygroscopic
c. The free dye acids are more easy to isolate and they are hygroscopic

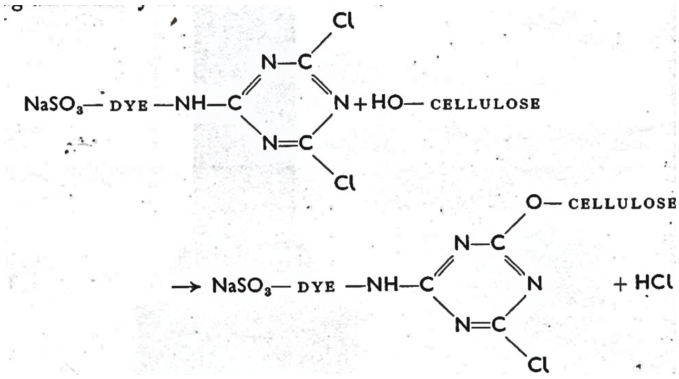
14. ***With migrating acid dyes:***
a. Its matter if the initial adsorption of color is irregular because boiling will not correct this.
b. ***It doesn't matter if the initial adsorption of color is irregular because boiling will correct this.***
c. It doesn't matter if the initial exhaustion of color is irregular because boiling will correct this.

15. ***With Colloidally dispersed acid dyes:***
a. The fibers should be in a swollen state to prevent freedom of movement.
b. The fibers should be in a swollen state to retard freedom of movement.
c. ***The fibers should be in a swollen state to help freedom of movement.***

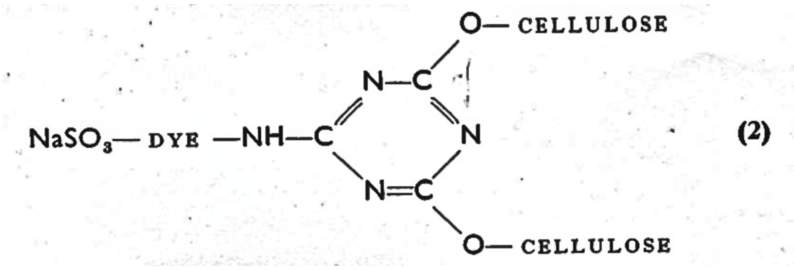
Third Question: (30 points)

1. "***All the triazinyl reactive dyes enter into combination with the cellulosic hydroxyl group are also, to a greater or less extent, hydrolysed by the hydroxyl ions in the dyebath, derived from the alkali". Explain*** **(10 points)**

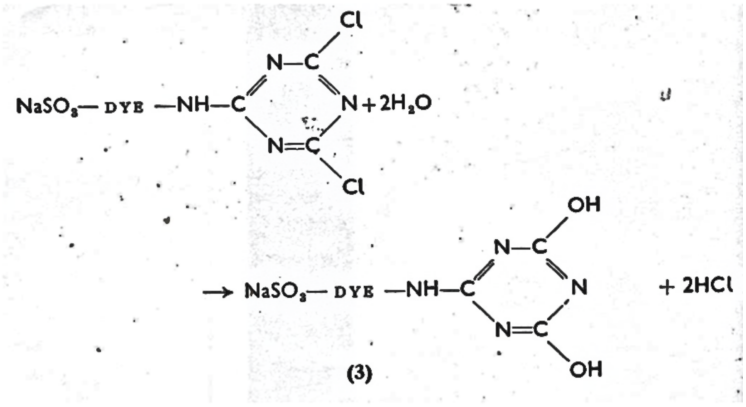
The reaction between a dichloro-triaziny1 dye and cellulose, which takes place at 20°C (68°F), is illustrated diagrammatically bellow:



And this can go to a stage further, although it dose not in all cases do so at 20°C (68°F), to link with two cellulose molecules, as in (2).

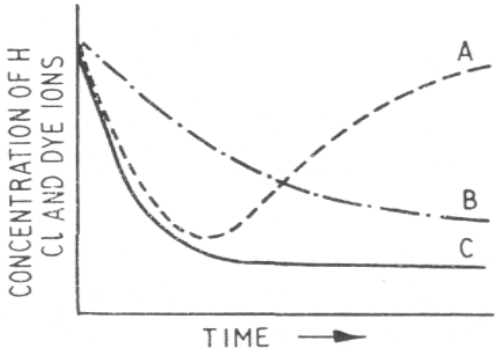


The triaziny1 dyes can, at the same time, undergo hydrolysis with water to form the compound represented by (3):

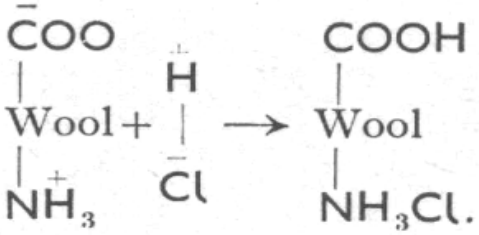


And this formation of the product of hydrolysis decreases the colour yield of the dye. Furthermore, compound of the type of (3) are substantive towards cellulose. They do not possess good wet-fastness because no covalent bond has been formed and, unless removed, can detract from the excellent properties of the dichlorotriaziny1 cellulose compound.

2. "***$WCOO.NH_3 + H^+ = W.COOH.NH_3^+$*** *This equation shows the function of hydrogen ions, created when the liquor is acidified, but it fails to answer the question as to what has happened to the anion of the added acid. Explain with diagrammatic curve the rate of adsorption of dye, hydrogen, and chlorine ions by wool in acidic dye bath? (10 point)*



It is apparent from curves *B* and *C* that in the initial stages there is rapid adsorption of both H^+ and Cl^- ions. The Cl^- ions are more mobile than the dye anions, and it is to be expected that they would reach the positively-charged sites in the fibre first:



It is obvious, however, from curves *B* and *C* that there is subsequently a gradual replacement of chlorine by dye ions in the fibre. It is not easy to understand why the slower-moving dye ions should succeed in replacing the chlorine. It has been suggested that when they reach the sites their electrostatic attraction is enhanced by other forces, such as hydrogen bonds and Van der Waals forces, giving, in total, a binding force greater than that of the chlorine.

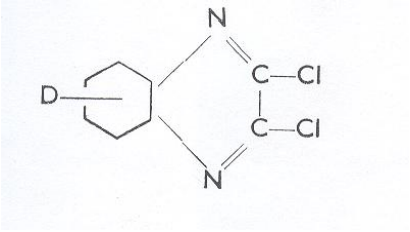
3. Write short notes on 2 of the following: (10 points)

- ***Stripping of reactive dyes.*** ***(5 points)***

Stripping is one of the reproduction processes, used in textile finishing, removing dyes from colored fabric. The process is either termed as 'back stripping' or 'destructive stripping'. In back stripping only the depth of shade is changed while in destructive stripping the dyes are chemically altered, such as dyes containing an azo group (–N=N-) can be chemically reduced to an almost colorless amine compound by using chemical reducing agents. Sometimes for the analysis of dyes or dyed fabrics, dyes may need to be stripped from the surface by either destructive or non-destructive methods. Non-destructive stripping is essential when the amount of dye on the fiber has to be estimated, or the dye has to be identified or analyzed by techniques such as chromatography.

- ***Levafix dyes.*** ***(5 points)***

In the original Levafix dyes the reactive group was $SO_2.NH.CH_2.CH_2.O.SO_2H$ and they were the precursors of the derivatives of $D.SO_2.NH.CH=CH_2$ which were formed under the conditions of dyeing. The reaction with cellulose was similar to the viny1 sulphone dyes. They had poor substantivity for cellulose under normal dye bath conditions and were only suitable for printing. Levafix E dyes contain the dichloroquinoxaline group in which the chlorine atoms are reactive:



They only react with cellulose in the presence of alkali. The goods are entered into the dye bath at 40°C and the quantity of common salt tabulated below is added in two or three portions. After 30 minutes soda ash, as tabulated, is added to bring about fixation which requires between 30 and 90 minutes according to the depth of the shade. The whole operation is carried out at 40°C. After dyeing, a hot rinse, soaping at the boil, followed by a cold rinse are necessary.

- ***Migration behavior of acid dyes.*** ***(5 points)***

The migration behavior of acid dyes of the three types already referred to, namely, *(a)* those molecularly dispersed at low temperatures *(b)* those colloidally dispersed at low temperatures but in molecular dispersion at higher temperatures, and *(c)* dyes colloidally dispersed at both low and high temperatures. Those of class *(a)* are level-dyeing and possess good migrating property

because the comparatively small dye anion can pass into and out of the fibre easily. The dyes of class *(b)* possess good levelling properties at high temperatures, and those of *(c),* owing to the large size of the colloidal aggregate, do not pass into and out of the fibre easily at any temperature. They have a marked tendency towards unlevel dyeing, but possess good wet-fastness.

Good Luck
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