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In fact, all the chemical processes of azo dye are done using water. And it is easy and cheap to avail water, even cleaning and disposing of it is simple. Due to all these reasons, azo dyes are cheap, easily produced, and widely used. Azo dyes are cheap, easily produced, and widely used.
of food. They do not fade when exposed to light and oxygen and are also heat resistant. This is the reason azo dyes are joined with fat soluble molecule, or they are dissolved as very fine elements. Moreover, some
azo dyes have been restricted for food usage due to their toxic side effects. The use of azo dyes in food products has been a matter of concern. Firstly it has been noticed that the body goes through a reaction when it absorbs certain azo dyes. This reaction produces certain cancer causing amines. The dye itself is not harmful. However, when it breaks
down, the amine that is produced is dangerous. Therefore, stringent rules have been implemented to ban the dyes which have cancer causing amines. Currently, one cannot say with surety whether the azo dyes used in cosmetics and products that are alike also have harmful elements when it is broken down. It has also not been determined whether
the levels of these materials are large enough to pose health hazards. Moreover, majority of the azo dye stuffs are considerably safe to use. It is also seen that highly industrialized countries have increased number of intestinal cancer cases. There are chances that they have some connection with azo dyes. The second reason for concern is the recent
finding wherein banned azo coloring is used in food products like chilli powder and ready to eat meals. This azo coloring agent is known as 'Sudan 1' and is used as red colorant. Sudan dyes are used mainly for oil, waxes, petrol or floor polish. Some corrupt food suppliers use cheap industrial dye to produce red color and add in spices and other food
products. In such cases, the dyes have been used illegally which has polluted the food products is very low. The level of toxins in azo dye is rather low. For example food products are usually colored with dyes. The level of dyes is in ratio
of one milligram of dye to per kilogram of food. Hence for an adult to reach a fatal dose, one needs to consume 100kg of azo colored food in one day. Normally azo dyes that are used in textile which can cause allergy to skin. However, such dyes are not used as food dyes. Furthermore,
azo dyes are in very small quantity to pose any direct health issues to the human immune system. However, some azo dyes like tartrazine have indicated to trigger the symptoms of asthma in people who have this disease. Moreover, the usage of azo dyes in food colors has claimed to cause hyperactivity in some children. Many studies have been
conducted on this topic but no proper indicator has been obtained to prove the fact. Till now it has not been proven that azo dyes or synthetic colors can cause hyperactivity in children. At the same time there have been no proofs to say that there are no effects. However, this matter cannot be ignored as it is a sensitive issue regarding the health of
children. Lastly, it has been detected that many degraded products of this dye are carcinogenic and therefore, some dyes have been restricted from being used in the food processing units due to their side effects. The dye itself does not cause any danger to health, but degradation of its elements creates
health risks. References: 1. Dyes-pigments.standardcon.com 2. Food-info.net 3. Csrchem2005.bootsglobal.com Table of Contents Azoic dye is produced by the combination of the Naphtha or coupling component and the Diazo compo
from other dyes, and its application process is also different. Azoic color is called Ice Color or Magic Color secunds, which are converted into azoic colors. Azoic
dyes are not soluble in water and must undergo a chemical reaction on the surface of the fiber to produce color. Typical azoic dye types include the following: Diazo Azo Dyes: These colors belong to a class of azoic dye types include the following: Diazo Azo Dyes: These colors belong to a class of azoic dye types include the following: Diazo Azo Dyes: These colors belong to a class of azoic dye types include the following: Diazo Azo Dyes: These colors belong to a class of azoic dye types include the following: Diazo Azo Dyes: These colors belong to a class of azoic dye types include the following: Diazo Azo Dyes: These colors belong to a class of azoic dye types include the following: Diazo Azo Dyes: These colors belong to a class of azoic dye types include the following: Diazo Azo Dyes: These colors belong to a class of azoic dye types include the following: Diazo Azo Dyes: These colors belong to a class of azoic dye types include the following: Diazo Azo Dyes: These colors belong to a class of azoic dye types include the following: Diazo Azo Dyes: These colors belong to a class of azoic dye types include the following: Diazo Azo Dyes: These colors belong to a class of azoic dye types include the following: Diazo Azo Dyes: These colors belong to a class of azoic dye types include the following: Diazo Azo Dyes: These colors belong to a class of azoic dye types include the following: Diazo Azo Dyes: These colors belong to a class of azoic dye types include the following: Diazo Azo Dyes: These colors belong to a class of azoic dye types include the following: Diazo Azo Dyes: These colors belong to a class of azoic dye types include the following: Diazo Azo Dyes: These colors belong to a class of azoic dye types include the following: Diazo Azo Dyes: These colors belong to a class of azoic dye types include the following: Diazo Azo Dyes: These colors belong to a class of azoic dye types include the following: Diazo Dyes: Diazo Dyes
dyed using this substance. Naphthol Azo Dyes: It provides a large variety of hues and is frequently used for vivid colours. They come from organic substances called naphthols. Fast Color Base Dyes: These dyes change color when they react with a coupling element. It offers outstanding fastness qualities and good resistance to fading, washing, and
 light exposure. Ice Azo Dyes:Ice dyes are a particular type of azoic dye in which the coupling component is printed on the cloth and the diazonium salt is added separately. Following that, the cloth is submerged in cold water to develop its color. Salt-free Azoic Dyes: When dying, this kind of azoic dye doesnt call for the inclusion of salt. The azoic dyes
 listed above are only a few examples. A variety of azoic dye variants and formulas are available. Every azoic dye has a unique set of properties and uses in the textile industry. The azoic color has some characteristics. The following are the characteristics of azoic color: Firstly, azoic dye is a water-insoluble dye. Secondly, azoic color consists of two
components; such as the Azoic coupling is done in alkaline condition. After that, textile dyeing operation is completed by two bath arrangement such as developing bath and impregnating bath. Basically, applicable for cellulosic fibers.
Also, the time of application is lengthy. Moreover, very bright shade produce by Azoic Color is good to excellent. However, azoic Color is comparatively cheap in price. Furthermore, wash fastness of azoic dye is very good. Dyeing process is run by three processes
such as Naphtholation, Diazotization and Coupling. Final color produce within few seconds after immersing the textile materials in the dye solution. Lastly, it uses for lighter shade dyeing. There are some benefits of azoic color. They are- Firstly, the color fastness of the azoic color is good. Secondly, it
has a wide color range. Thereafter, it has a versatile application area. Moreover, it is cost-effective than other dyes. It is compatible to use with different dyeing, and printing techniques. Also, it has the ability to absorb light. Lastly, the environmental impact is low. Azoic dye is a widely used synthetic dye. Although there are some advantages of azoic
dyes but it has also some disadvantages. The followings are the disadvantages of azoic dyes are dyed or come into touch with moisture, a small number of aromatic amines may leak which may be harmful to health. Environmental Issues: The main environmental safety issue with azoic dyes is the emission of
aromatic amines during the dyeing process. The environment and water body will be affected if the colors are not adequately removed or handled while washing. Use Restricted: Because of the possible health and environmental dangers associated with azoic dyes that include aromatic amines in their chemical makeup, there may be certain
restrictions on how these colors are used. Issues with Color Fastness: This dye occasionally exhibits poor color fastness and may fade or bleed when exposed to light or other environmental factors. Application Complexity: Applying azoic dye is more difficult than applying other dyes. It must accurately regulate every dying parameter or the dyeing will
be flawed. Limited color spectrum: They may not be able to obtain the complete gamut of colors that other forms of dye may offer, but they can generate a vivid and powerful color. The makers are restricted from using azoic colors within this color spectrum. In conclusion, its critical to be mindful of both the health danger and the environmental
safety while using azoic dyes. The firm has to use ETP to treat the colored water. The ecosystem will be secure if the manufacturing industry to produce different color. The following is the application area of azoic dyes. They are-Textile
Industry Leather Industry Paper Industry Paper Industry Plastic and Polymer Industry Plastic Andrew 
So, select your dyes as you need. I'm a textile engineer who is passionate about writing about the textile industry. With a B.Sc. in Textile Engineering, I've gained extensive knowledge about textile manufacturing and sustainable practices. My focus revolves around refining manufacturing processes, maintaining product quality, and staying updated on
the latest textile technology advancements. If you're interested in collaborating on articles or have any pieces you'd like to submit, let's connect and discuss further! Azo dyes are a type of direct dye - meaning that they color the fibers "directly", which eliminates the need for a mordant. Azo dyes are one of the main types of direct dye - meaning that they color the fibers "directly", which eliminates the need for a mordant. Azo dyes are one of the main types of direct dye - meaning that they color the fibers "directly", which eliminates the need for a mordant. Azo dyes are one of the main types of direct dye - meaning that they color the fibers "directly", which eliminates the need for a mordant. Azo dyes are one of the main types of direct dye - meaning that they color the fibers "directly", which eliminates the need for a mordant. Azo dyes are one of the main types of direct dye - meaning that they color the fibers "directly", which eliminates the need for a mordant. Azo dyes are one of the main types of direct dye - meaning that they color the fibers "directly", which eliminates the need for a mordant. Azo dyes are one of the main types of direct dye - meaning that they color the fibers "directly", which eliminates the need for a mordant. Azo dyes are one of the main types of direct dye - meaning that they color the fibers "directly", which eliminates the need for a mordant and the fibers "directly", which eliminates the need for a mordant and the fibers "directly", which eliminates the need for a mordant and the fibers "directly", which eliminates the need for a mordant and the fibers "directly", which eliminates the need for a mordant and the fibers "directly", which eliminates the need for a mordant and the fibers "directly", which eliminates the need for a mordant and the fibers "directly", which eliminates the need for a mordant and the fibers "directly", which eliminates the need for a mordant and the fibers "directly", which eliminates the need for a mordant and the fibers "directly", which elimi
industry. They are known to be potential carcinogens. They were first regulated in the EU by Germany and the list is commonly called the "German banned dye list". If a product has not been made containing these compounds, it is sometimes called "azo free". That's misleading because the number of dyes on the list is very small compared to the total
number of azo dyes which are still used. And with a few exceptions, the banned dyes on the list have not been used in the past 20 years, so the bans didn't change manufacturing much. Studies have found that the dyes are resistant to municipal waste water treatment facilities and pass into the environment relatively unchanged. Textile mill effluent
contains 5 20% of original dyestuff, plus salt and dye fixing agents. Some azo dyes break down during use and release chemicals known as aromatic amines, some of which can cause cancer typically bladder and liver cancers, 2 but studies also link them to breast cancer. 3They also cause damage to human DNA. 4They are easily absorbed by skin
exposure.5 The European Union has banned the use of these azo dyes that release cancer-causing amines in any textiles that come in contact with human skin.6 1Ferraz, Elisa R.A. et al.; "The azo dye Disperse Orange 1 induces DNA damage and cytotoxic effects but does not cause ecotoxic effects in Daphnia similis and vibrio fischeri", Journal of
 Hazardous Materials, Aug. 30, 2011, Vol 192, Issue 2, pp. 628-6332Dom N, Knapen D, Benoot D, Nobels I & Blust R (2010). Aquatic multi-species acute toxicity of (chlorinated) anilines: Experimental versus predicted data. Chemosphere 81(2): 177-13 F.M.D. et al., "Azo dyes and their metabolites: Does the discharge of the Azo dye into water bodies
represent human and ecological risks", 1991, all PCP-containing products sold and used in the EU have been imported (EU production was banned under Directive 76/769/EEC). Now entry number 22 of Annex 17 of the EU chemical law REACH prohibits the marketing and use in the EU of PCP and its salts and esters in products in a concentration
equal to or greater than 0.1 per cent. Commission Regulation (EC) No 552/2009 of 22 June 2009, op cit. (REACH) Class of organic compounds used as dyeChemical structure of Solvent Yellow 7, an orange colored azo dye. Azo dyes are organic compounds used as dyeChemical structure of Solvent Yellow 7, and orange colored azo dye. Azo dyes are organic compounds used as dyeChemical structure of Solvent Yellow 7, and orange colored azo dye. Azo dyes are organic compounds used as dyeChemical structure of Solvent Yellow 7, and orange colored azo dye. Azo dyes are organic compounds used as dyeChemical structure of Solvent Yellow 7, and orange colored azo dye. Azo dyes are organic compounds used as dyeChemical structure of Solvent Yellow 7, and orange colored azo dye. Azo dyes are organic compounds used as dyeChemical structure of Solvent Yellow 7, and orange colored azo dye. Azo dyes are organic compounds used as dyeChemical structure of Solvent Yellow 7, and orange colored azo dye. Azo dyes are organic compounds used as dyeChemical structure of Solvent Yellow 7, and orange colored azo dye. Azo dyes are organic compounds used as dyeChemical structure of Solvent Yellow 7, and orange colored azo dyeChemical structure of Solvent Yellow 7, and orange colored azo dyeChemical structure of Solvent Yellow 7, and orange colored azo dyeChemical structure of Solvent Yellow 7, and orange colored azo dyeChemical structure of Solvent Yellow 7, and orange colored azo dyeChemical structure of Solvent Yellow 7, and orange colored azo dyeChemical structure of Solvent Yellow 7, and orange colored azo dyeChemical structure of Solvent Yellow 7, and orange colored azo dyeChemical structure of Solvent Yellow 7, and orange colored azo dyeChemical structure of Solvent Yellow 7, and orange colored azo dyeChemical structure of Solvent Yellow 7, and orange colored azo dyeChemical structure of Solvent Yellow 7, and orange colored azo dyeChemical structure of Solvent Yellow 7, and orange colored azo dyeChemical structure of Solvent Yellow 7, and orange
groups. They are a commercially important family of azo compounds, i.e. compounds containing the CN=NC linkage.[1] Azo dyes are synthetic dyes and do not occur naturally.[2][3] Most azo dyes compounds contain only one azo group but there are some that contain two or three azo groups, called "diazo dyes" and "triazo dyes" respectively. Azo dyes comprise
 6070% of all dyes used in food and textile industries.[3] Azo dyes are widely used to treat textiles, leather articles, and some foods. Chemically related derivatives of azo dyes are known, and several classification systems exist. Some classes include
of a direct dye, used for cotton. As a consequence of -delocalization, aryl azo compounds have vivid colors, especially reds, orange, and yellows. An example is Disperse Orange 1. Some azo compounds, e.g., methyl orange, are used as acid-base indicators. Most DVD-R/+R and some CD-R discs use blue azo dye as the recording layer. Many phenolic
diazo dyes participate in tautomeric equilibria shown here in simplified form (Ar = aryl).[6]Azo dyes are solids. Most are salts, the colored component being the anion usually, although some cationic azo dyes are known. The anionic character of most dyes are solids. Most are salts, the colored component being the anion usually, although some cationic azo dyes are known. The anionic character of most dyes are solids.
article:RSO3H RSO3 + H+Most proteins are cationic, thus dyeing of leather and wool corresponds to an ion exchange reaction. The anionic dye adheres to these articles through electrostatic forces. Cationic azo dyes typically contain quaternary ammonium centers. Trans-cis isomerization of azo-POSS, leading to the folding the dodecyl alkyl tail on the
 POSS head[7]A unique property of azo dyes is their ability to undergo reversible photoisomerization between trans and cis configurations. In the trans isomer, the aromatic rings (or other substituents) are on opposite sides of the double bond, resulting in a more extended and linear conformation. Upon exposure to ultraviolet (UV) light, typically at
 365 nm,[7] the molecule absorbs energy and converts to the cis isomer, where the substituents are on the same side of the N=N bond, leading to a bent or kinked structure. This process is reversible: the cis form can thermally relax back to the trans form over time, or be actively reverted using visible light irradiation (commonly around 450500 nm),
 depending on the substituents and molecular environment. Most azo dyes are prepared by azo coupling, which entails an electrophilic substitution reaction of an aryl diazonium cation with electron-donating groups: [8] ArN+2 + ArH ArN=NAr +
 H+In practice, acetoacetanilides are widely used as coupling partners: ArN+2 + ArNHC(O)CH2C(O)Me ArN=NCH(C(O)Me)(C(O)MHAr) + H+Azo dyes are also prepared by the condensation of nitrated aromatic compounds with anilines followed by reduction of the resulting azoxy intermediate: ArNO2 + ArNH2 (O)=NAr + H2OArN(O)=NAr + H2OARN(O
C6H12O6 ArN=NAr + C6H10O6 + H2OFor textile dying, a typical aniline partner would be disodium 4,4-dinitrostilbene-2,2-disulfonate. Typical aniline partners are produced by partial reduction of aromatic nitro compounds. [5]Many azo dyes are produced by partners are shown below.
reactions from pre-existing azo compounds. Typical reactions include metal complexation and acylation. Illustrative azo dyes or their precursorsDirect Brown 78Direct Blue 1Basic Red 18, a cationic azo dyeAzo pigments are similar in chemical structure to azo dyes, but they lack solubilizing groups. [9] Many so-called azo pigments are not strictly
classifiable as azo compounds since they exist as keto hydrazide tautomers, which lack the -N=N- linkage.C.I. Pigment Yellow 12, an azo pigment (also classified as a diarylide pigment). Azo pigment sare important in a variety of plastics, rubbers, and paints (including artist's paints). They have excellent coloring properties, mainly in the yellow to red
range, as well as good lightfastness. The lightfastness depends not only on the properties of the organic azo compound, but also on the way they have been absorbed on the pigment carrier. In order for dyes to be useful, they must possess a high degree of chemical and photolytic stability. As a result of this stability, photolysis is not considered to be a
degradation pathway for azo dyes. In order to prolong the lifetime of products dyed with azo dyes biodegrade negligibly in short term tests under aerobic conditions. Under anaerobic conditions, however, discoloration may be observed as a consequence of
biodegradation.[10]Many azo pigments are non-toxic, although some, such as dinitroaniline orange, or pigment orange 1, 2, and 5 are mutagenic and carcinogenic.[11][12]Azo dyes derived from benzidine are carcinogens; exposure to them has classically been associated with bladder cancer.[13] Accordingly, the production
of benzidine azo dyes was discontinued in the 1980s in many western countries. [5] Certain azo dyes degrade under reductive conditions to release any of a group of defined aromatic amines. Since September 2003, the European Union has banned the manufacture or sale of consumer goods which contain the listed amines. Since only a small number
of dyes produced those amines, relatively few products were actually affected.[4]Azo couplingPonceau 4RPonceau 4RPonceau 4RPonceau 4RPonceau 5Glycoazodyes^ IUPAC, Compendium of Chemical Terminology, 5th ed. (the "Gold Book") (2025). Online version: (2006) "azo compounds". doi:10.1351/goldbook.A00560^ Benkhaya, Said; M'rabet, Souad; El Harfi, Ahmed (31 January
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Disclaimer | PMC Copyright Notice . 2020 Jan 31;6(1):e03271. doi: 10.1016/j.heliyon.2020.e03271In this work, we have presented a very detailed review of the different classification of azo dyes as a function of the number of azo groups and the appropriate functional groups. Then we pointed out some chemical properties of these dyes such as
reactivity, isomerization and tautomerism and listed. In the following, we have summarized some recent syntheses of azo dye/polymer conjugation. Finally, we indicate the principle of Gewald's reaction and its application to the synthesis of new azo dyes. Keywords: Organic chemistry, Azo dye, Polymer dyes, Gewald's reaction and its application to the synthesis of new azo dyes. Keywords: Organic chemistry, Azo dye, Polymer dyes, Gewald's reaction and its application to the synthesis of new azo dyes. Keywords: Organic chemistry, Azo dye, Polymer dyes, Gewald's reaction and its application to the synthesis of new azo dyes.
reaction, Textile industryOrganic chemistry today, and their relative importance may even increase in the future. They play a crucial role in the governance of the dye and printing market. These dyes are synthesized from a
simple method of diazotization and coupling. Different routes and modifications are made to obtain the desired color properties, yield and particle size of the dyes are the most used in industry are azo dyes [4, 5].
These compounds are characterized by the functional group (-N=N-) uniting two symmetrical and/or asymmetrical identical or non-azo alkyl or aryl radicals [6]. Azo dyes are the most important synthetic colorants which have been widely used in textile, printing, paper manufacturing, etc. [7]. As well as their harmful effects of azo dyes on humans and
 aquatic life, have aroused urgent calls for the treatment of effluents containing azo dyes to eliminate them or convert them into useful and safe products, [8, 9]. In addition, the distribution of dyes in water increased with the increased with the increased with the molecular weight of the azo dyes in the molecular weight of the azo dyes in the
form of increased azo bonds, resulting in a decrease in the rate degradation of azo dyes are synthesized by diazotization of an aromatic primary amine, followed by coupling with one or more electron-rich nucleophiles such as amino and hydroxy [2]. There are other methods of synthesis of azo dyes among these are [10, 11]: reduction of
 nitroaromatic derivatives in alkaline medium, reduction of nitroso compounds by AlLiH4, oxidation of primary amines by permanganate potassium or lead tetraacetate, condensation of hydrazines and quinones, condensation of primary amines by permanganate potassium or lead tetraacetate, condensation of primary amines by permanganate potassium or lead tetraacetate, condensation of hydrazines and quinones, condensation of primary amines by permanganate potassium or lead tetraacetate, condensation of primary amines by permanganate potassium or lead tetraacetate, condensation of primary amines by permanganate potassium or lead tetraacetate, condensation of primary amines by permanganate potassium or lead tetraacetate, condensation of primary amines by permanganate potassium or lead tetraacetate, condensation of primary amines by permanganate potassium or lead tetraacetate, condensation of primary amines by permanganate potassium or lead tetraacetate, condensation of primary amines by permanganate potassium or lead tetraacetate, condensation of primary amines by permanganate potassium or lead tetraacetate, condensation of primary amines by permanganate potassium or lead tetraacetate, condensation of primary amines by permanganate potassium or lead tetraacetate, condensation of primary amines by permanganate potassium or lead tetraacetate, condensation of primary amines by permanganate potassium or lead tetraacetate, condensation of primary amines by permanganate potassium or lead tetraacetate, condensation of primary amines by permanganate potassium or lead tetraacetate, condensation of primary amines by permanganate potassium or lead tetraacetate, condensation of primary amines by permanganate potassium or lead tetraacetate, condensation of primary amines by permanganate potassium or lead tetraacetate, condensation of primary amines by permanganate potassium or lead tetraacetate, condensation of primary amines by permanganate potassium or lead tetraacetate, condensation or lead tetraacetate potassium or lead tetraaceta
heterocycles or to enolizable aliphatic groups [12]. These are essential to give the color of the dye, with their shades of different intensities. In general, the chemical structure of an azo dye is represented by a backbone, the auxochrome groups, the chromophoric groups and the solubilizing groups according to Figure 1, [13,14,15]. These are essential to give the color of the dye, with their shades of different intensities. In general, the chromophoric groups and the solubilizing groups according to Figure 1, [13,14,15].
dyes is determined by the azo bonds and their associated chromophores and auxochromes, [2, 16]. Structure of the azo reactive dye. The azo dyes are generally characterized by a chemical groups capable of forming covalent bonds with the textile substrates. The energy required for the rupture of these bonds is similar to that used to degrade the
 support itself. The objective of this review is to describe a chemical classification of azo dyes and their structural characteristics. It is presented by synthesis of some azo dyes according to the most common method, which comprises the diazonium salt obtained with a generally aromatic
 substrate on the one hand and the synthesis of azo dyes contains chemical groups hydrazone (2), the synthesis of azo dyes contains chemical groups hydrazone (2), the synthesis of azo dyes contains chemical groups hydrazone (2), the synthesis of azo dyes contains chemical groups hydrazone (2), the synthesis of azo dyes contains chemical groups hydrazone (2), the synthesis of azo dyes contains chemical groups hydrazone (2), the synthesis of azo dyes contains chemical groups hydrazone (2), the synthesis of azo dyes contains chemical groups hydrazone (2), the synthesis of azo dyes contains chemical groups hydrazone (2), the synthesis of azo dyes contains chemical groups hydrazone (3), the synthesis of azo dyes contains chemical groups hydrazone (3), the synthesis of azo dyes contains chemical groups hydrazone (3), the synthesis of azo dyes contains chemical groups hydrazone (3), the synthesis of azo dyes contains chemical groups hydrazone (3), the synthesis of azo dyes contains hydrazone (3), the synthesis of azo dyes hydrazone (3), t
the concept of conjugation of azo dyes to polymers and finally the use of the Gewald reaction in the synthesis of azo dyes are distributed according to the number of azo dyes are supplied with numbers
ranging from 11,000 to 39,999 in correspondence with the chemical structure (Table1). The color index number, developed by the society of dyers and colorists, is used for dye classification [17]. Classification of azo dyes in Colour Index [2, 18]. Chemical class CI
noMonozo1100019999Disazo2000029999Trisazo3000034999Polyazo3500036999Azoic3700039999The monoazo dyes can be schematically represented by the following formula: Z-N=NW [19]. Figure 2 gives an ancient analog of this family which dyes cotton [20], it is characterized by their orange color. Structure of chrysoidine. Other homologs
(Figure 3), were characterized by better light fastness and washing and used for coloring cellulose acetate, polyamides, polyesters, and polyacrylonitrile. Structure of the orange dye. Among the mono azoic acid dyes, mention
may be made of orange IV (Figure 5) and the yellow dye (Figure 6), which is used for dyeing wool and nylon. Orange IV. Structure of the yellow dye (Figure 7) and the yellow dye (Figure 6), which is used for dyeing wool and nylon. Orange IV. Structure of the yellow dye (Figure 6), which is used for dyeing wool and nylon. Orange IV. Structure of the yellow dye (Figure 6), which is used for dyeing wool and nylon. Orange IV. Structure of the yellow dye (Figure 6), which is used for dyeing wool and nylon. Orange IV. Structure of the yellow dye (Figure 6), which is used for dyeing wool and nylon. Orange IV. Structure of the yellow dye (Figure 6), which is used for dyeing wool and nylon. Orange IV. Structure of the yellow dye (Figure 6), which is used for dyeing wool and nylon. Orange IV. Structure of the yellow dye (Figure 6), which is used for dyeing wool and nylon. Orange IV. Structure of the yellow dye (Figure 6), which is used for dyeing wool and nylon. Orange IV. Structure of the yellow dye (Figure 6), which is used for dyeing wool and nylon. Orange IV. Structure of the yellow dye (Figure 6), which is used for dyeing wool and nylon. Orange IV. Structure of the yellow dye (Figure 6), which is used for dyeing wool and nylon. Orange IV. Structure of the yellow dye (Figure 6), which is used for dyeing wool and nylon. Orange IV. Structure of the yellow dye (Figure 6), which is used for dyeing wool and nylon. Orange IV. Structure of the yellow dye (Figure 6), which is used for dyeing wool and nylon. Orange IV. Structure of the yellow dye (Figure 6), which is used for dyeing wool and nylon. Orange IV. Structure of the yellow dye (Figure 6), which is used for dyeing wool and nylon. Orange IV. Structure of the yellow dye (Figure 6), which is used for dyeing wool and nylon. Orange IV. Structure of the yellow dye (Figure 6), which is used for dyeing wool and nylon. Orange IV. Structure of the yellow dye (Figure 6), which is used for dyeing wool and nylon dye (Figure 6), which is used for dye (Figure 6), which is used for d
mordant (a), the blue dye (b) and the blue dye (c). They are widely used for dyeing polyamide substrates in black and gives a chromium complex, an example of this family is the the textile dye Mordant Black 17, [CI No.15705], a monosulfonated aromatic azo compound widely used in a large scale by several textile and dyeing industries was obtained
from Sigma-Aldrich, USA [21, 22], (Figure 8). Mordant black 17. In general, the diazo dyes contain two groups N=N-, they are obtained according to the following three methods [23]. The synthesis of this type of dye was made by a coupling reaction of two moles of di azoic acid on the same coupling term. Globally, these dyes are derivatives of
resorcinol and m-phenylenediamine, they are brown, green, matt blue and black. Figure shows an example of a brown dye structure. Also, this type has a large number of direct dyes with respect to the small number of acid and mordant dyes. They are derived from a diamine which is diazotized twice and copulated with
identical or different terms. Figure 10 shows the structure of the blue direct dye contains benzidine function. Structure blue direct dye contains benzidine function. Structure blue direct dye. Figure 11 shows an example of a synthesized by the coupling of an amino
azoic acid with a phenolic coupler. Figure 12 shows an analogue of this type of dye [26]. Structure of the orange direct dye.Polyazo dyes are complex dyes is characterized by the repetition of the azo group from three or more times in the same molecule. They are intended for dyeing leather, with dark shades: red, brown and dark black. The most
common dye for this kind of dye is direct red (Figure 13), [26,27,28]. The latter can be synthesized by the phosgenate of the appropriate diazo dye. This can be achieved by diazotising 6-amino-3,4-azodibenzenesulfonic acid following acid coupling of N-acetyl-J. The acetyl-J. The ac
dye.A synthetic route of a homologue of mono chlorotriazine dyes is shown in Figure 14, [29]. Synthesis route of an example of monochlorotriazine dyes. Figure 15 shows the chemical structure of the monofunctional azo reactive dye which carries the dichlorotriazine dyes. Figure 15 shows the chemical structure of the monofunctional azo reactive dye which carries the dichlorotriazine dyes.
 cellulose at a temperature of 20 C30 C. The replacement of a single chlorine by the hydroxyl ion or the cellulosic ion leads to a remarkable decrease in the reactivity of the atoms of the triazine ring, while the chlorine atom
is inactivated and the carbon which bonds to the chlorine becomes less electrophilic. It has the same chromophoric groups of dichloro triazine. The link -NH- linking the chromophore and the group have an influence on the
dyeing properties and the solubility of the dye [32]. Structure of the Cibacron shiny red dye B.The binding of mono and dichloro triazine is effected by a nucleophilic substitution mechanism due to the attracting electron effect of the nitrogen atoms of the triazine nucleus [33, 34]. In an alkaline environment. The reaction of the hydrolysis was
 deactivated the carbon carries the atom of chlorine. The electronic doublets of the triazine nucleus have been delocalized by the negative charge of the hydroxyl ion, so the carbon enclosure becomes rich by electrons, (Figure 17). Mechanism of fixing and hydrolysis of the mono and dichloro triazine dye. In general, include the di and tri-chor pyrimidine
derivatives, chlorfluoropyrimidine and fluoropyrimidine was obtained, on the one hand, by the reaction of trichloro pyrimidine was obtained, on the one hand, by the reaction of trichloropyrimidine was obtained, on the one hand, by the reaction of trichloropyrimidine was obtained, on the one hand, by the reaction of trichloropyrimidine was obtained, on the one hand, by the reaction of trichloropyrimidine was obtained, on the one hand, by the reaction of trichloropyrimidine was obtained, on the one hand, by the reaction of trichloropyrimidine was obtained, on the one hand, by the reaction of trichloropyrimidine was obtained, on the one hand, by the reaction of trichloropyrimidine was obtained, on the one hand, by the reaction of trichloropyrimidine was obtained, on the one hand, by the reaction of trichloropyrimidine was obtained, on the one hand, by the reaction of trichloropyrimidine was obtained, on the one hand, by the reaction of trichloropyrimidine was obtained, on the one hand, by the reaction of trichloropyrimidine was obtained, and the reaction of trichloropyrimidine was obtained and the reaction of the reaction of t
 substitution of chlorine in tetrachloro pyrimidine by an arylamine. These types of dyestuffs require a more light temperature range which can reach boiling point, in order to have a good fixation on a cellulosic type textile material. This type of dye was formed by a bond with the textile material more resistant to hydrolysis. C.I.Reactive red 17.The
increase in the reactivity of this kind of dyes was made by the substitution of chlorines by fluorine. The bond formed with the textile fiber has been more stable in an acid medium, but in the presence of light, this bond becomes sensitive to oxidation by the peroxide compounds [32]. The ideal temperature for a good fixation of this type of dye is
between 40 C and 50 C. Figure 19 gives an example of these dyes which have belonged to the range of commercial dyes of the Drimaren K or Levafix E-A type. Dye type 5-chloro-2, 4-difluoropyrimidine dyes, and difluoro pyrimidine dyes [32]. Under
the effect of peroxides and in the presence of light and/or heat, the fiber-dye bond has been less resistant to strength. The optimum temperature for a good fixation is of the order of 50 C. These dyes belong to the Levafix E. Azo red dye ractif Levafix E. The reactive part of these types of cores comprises the -
 sulfatoethylsulphone functional group (SO2- (CH2)2 OSO3Na). The latter was inactive in an acidic and neutral medium according to the reaction of the active part of the vinyl sulfone-type. The attachment mechanism with the cellulosic fibers was carried out by a reaction of the
nucleophilic addition, which produces a cellulose ether (Figure 22). As the hydroxyethyl sulfone [32, 35]. Fastening mechanism with cellulose fiber. In terms of reactivity, this type of dye was positioned between high-reactivity heterocyclic systems such as dichloro triazines and difluoro pyrimidines on the one hand. And
that of low reactivity based on mono chlorotriazine or trichloro pyrimidine on the other hand. The affinity of these dyes was low compared to that of halohydrocyclics. It is characterized by good water fastness in an acid medium, its optimum pH-binding temperature was given in an interval of 40 C60 C. Among the trade names which represent this
type of dye, Remazol is found (Figure 23). Structure of the group (-O-SO3Na). This solubility has been decreased and the affinity for cellulose increases after the reaction of removal of the sulfone group in an alkaline medium. This type of
dye was applied to the cellulosic fiber substrates because of its better affinity for depletion at a temperature of 80 C, which makes it possible to obtain a fixation rate between 70 and 80 %. The molecules of this kind of dye have been characterized by a twofold dimension to its homo-functional counterpart [32, 36], (Figure 24). Structure of the dye C.I.
 Reactive Blue 171. These dyes was obtained by a substitution reaction of the chlorine in the triazine ring by a carboxy pyridine acid. The application temperature at depletion is higher than boiling in a neutral medium and can also be applied at 80 C at pH = 11 as in the case of mono chlorotriazine. The coloring and the solidity of these dyes with the
 cellulosic substrates are similar to those of the mono chlorotriazine dyes. The reactivity of bis aminonicotinotriazine (Figure 25) is higher than dichloro quinoxalines. Structure of the dye C.I Reactive Red 221. The Monochlorotriazine
 sulphatoethylsulfone can be synthesized by the reaction of dichloro triazine with the arylamine containing the sulphatoethylsulfone to adsorb to fibers in a bifunctional form, because of their high affinity. The existence of two types of
 fiber-dye bonds promotes different degrees of solidity. While the bonds formed by this type of dye have more acid fastness than for difluoro pyrimidines and dichloquinoxalines. Figure 26 illustrates an example of supra-gloss Sumifixe red 2BF (NSK)
[38, 39]. Structure of the C.I. Reactive Red dye 194. Generally synthesized by an aliphatic moiety bonded to the sulphatoethylsulfone moiety and attached to the second reactive moiety of mono fluoro triazine [32]. The cost of making these dyes is high compared with the other dyes, but this cost is compensated by their higher yield in semi-continuous
dyeing (Pad-Batch or Pad-Roll), their medium to high Their performance washability, high fixation and stability in the cold dyeing bath. Figure 27 gives an example of these dyes, which were presented by Ciba C from the company Ciba-Geigy which appeared in 1988, [32]. Structure of the mono fluoro triazine-sulphatoethylsulfone dye. Among the
 addition reactions of the azo group, the hydrogenation leading to hydrogen peroxide and oxidation by hydrogen peroxide and peracids which promote the compounds was reported between 1630-1575 cm1. This frequency may be absent in the
case of the existence of asymmetric azo derivatives [40, 41]. Addition reactive, followed by di or tetrafluoropyrimidines [43] (d) and dichloroquinoxalines [43] (e) followed by monofluorotriazines [45] (f). The
dyes of medium reactivity are represented by vinylsulfones, the bifunctional dye type monochlorotriazines having low reactivity are found. Finally, the trichloropyrimidines have the lowest reactivity (Figure 29). Chemical structures of (c), (d), (e) and
(f). Substantivity is the power to absorb a dye on a textile support surface, depending on the reactive part of the dye being studied [46]. Figure 30 shows the diagram of the substantivity in ascending to their reactive part. The azobenzene molecule
 admits two isomeric forms Z and E. The form E being unstable, it is obtained from the trans form by photoisomerization (Figure 31) [26,48]. Form Z and E of the azobenzene molecule that has exactly the same atoms, but the atoms have a different layout
 In some molecules and under certain conditions, isomerization occurs spontaneously. The key to the interesting applications of azobenzene is the isomerization and the metastable Z form [49,50,51,52,53]. In an acid medium, the two Trans and Cis forms of the azobenzenes cause the
of azo-substituted azobenzenes in ortho or para in an azo moiety [54]. Azophenol-quinone hydroxyazobenzene tautomerism of hydroxyazobenzene tautomerism of hydroxyazobenzene tautomerism of hydroxyazobenzene tautomerism of hydroxyazobenzene tautomerism. The azo/hydrazone tautomerism of hydroxyazobenzene tautomerism.
 allomerism tautomerism is of importance for azo dyes by the development of certain characteristics such as light fastness, dye tinctorial power, and the like. The latter determines the profitability of the dye. Therefore the azo dyes must be in the form of an abundant tautomer which is the hydrazone [59, 60]. This phenomenon was discovered in 1884
condensation of phenylhydrazine with 1, 4-naphthoquinone. In general, the tautomerism (Figure 35), [64]. Form of tautomerism. Depending on the medium, the hydroxy azo dyes give at
the same time different percentages of the tautomers azo and hydrazone, as well as azo phenol dyes which exist in azo form, with the exception of certain particulars cases [63, 65], (Figure 36). Azophenol dyes which are in hydrazone form azo-actoactanilide [66, 67], azo-pyrazolone [68] and azo-pyridone
[69]. Strucure of azo-actoactanilide, azo-pyrazolone and azo-pyridone. Moreover, the instability of the imino group entails the azo form of the different kinds of dyes, (Figure 38). Imino and azo form and the other in hydrazo form
(Figure 39). Protonated tautomerism. In the case where the protonation is carried by , it favors an azonium tautomer stabilized by resonance. The protonation tautomerism of the azo colorants is done only in the colored indicators. This section will deal with the use of the Gewald reaction in the synthesis of
 conventional and functional dyes [122,133]. This reaction has applications in several fields, such as peptide analogues, dyes and electronic materials; Conjugated carbohydrates, agrochemicals, pharmaceuticals/biomedicine, cane masters, etc. According to Ram W. Sabnis [71], the condensation of benzo-thiophene-3 (2H) -one-1,1-dioxide with ethy
cyanoacetate was subsequently diazotised using nitrosyl sulfuric acid and coupled with Aryl amines substituted with N, N-dialkyl (acid coupling) gave azo dyes 26 (Figure 40), [71]. Azo dyes 26.According to same author [71], A series of novel azo dispersed dyes were synthesized from 4, 5-hetero-2-aminothiophenes. The key intermediate is 5-amino-6-
cyano-2-phenylthienooxazole. The latter was prepared from 2-phenyl-5-4H-oxazolone, sulfur and malononitrile by the Gewald reaction, which was diazotized with nitrosyl sulfuric acid and coupled with N, N. The substituted arylamines with a dialkyl group at acid pH gave dyes -azo-thieno-oxazoles 27 [72], (Figure 41). 5-azo-thieno [2, 3-d] oxazoles dyes
27.Rangnekar etal. [71], have been demonstrated the using of 2-amino-3-cyano- and 2-amino-3-a
obtain monoazo dyes. The alkaline hydrolysis of monoazo dyes resulted in arylamino monoazothiophenes, which were diazotized with nitrosylsulfuric acid and coupled to 2-naphthol and N, N-dimethylaniline, gave deeply coloured disazo disperse dyes 38 (Figure 42), [71]. Dispersed diazo dyes 38. According to Rangnekar etal. [71], another series of
disazo disperse dyes 39 have been reported using 2-aminothiophene via the Gewald reaction, as illustrated in Figure 43, [71]. Disazo disperse dyes 39. According to Wardakhan et al. [73], aniline was diazotised and coupled with the corresponding 2-amino-3-cyano-4-aryl-substituted thiophenes at the 5-position of the thiophene moiety, yielding
azothiophene dyes 42 [73], (Figure 44). Azothiophene dyes 42. Azo dyes are synthetic compounds containing an azo bond N=N-, obtained mainly from the aromatic amine substrate, nitro and nitroso. The synthesis processes rely on the use of an appropriate oxidizing/reducing reaction or a diazotization/coupling reaction. This is considered one of the
most important reaction in the development of industrial organic chemistry. The synthesis of an aco dye, [31, 32]. Synthesis of azo dye, [31, 32]. Synthesis of azo dye, [31, 32].
good stirring at 0 C to minimize contact with water to produce phenol and are used immediately in the coupling reaction. To complete the synthesis of the azo dye, the diazonium salt reacts as an electrophilic aromatic substitution
mechanism. The hydroxyl or amine group directs the aryl diasonium ion to the para site in the event that this site is not occupied, otherwise it will be attached to the ortho position. There are other methods for the synthesis of azo dyes [26,75] among which we found the reduction of the nitroaromatic derivatives in alkaline medium, the reduction of
the nitrosated compounds by AlLiH4, the oxidation of the primary amines by the potassium permanganate or lead tetraacetate, condensation of hydrazines and quinones and quinones and condensation of primary amines by the potassium permanganate or lead tetraacetate, condensation of hydrazines and quinones and quinones and quinones and condensation of hydrazines and pigments are manufactured on an industrial scale by the same reaction sequence in two stages,
diazotization and azo coupling. Overall, there are five strategies for the synthesis of azo dyes based on the diazotization/coupling reaction. Each strategy has certain restrictions associated with the availability of substrates. The two reactions 1 and 2 below are intended for the preparation of symmetrical azo compounds (Figure 46). In the case where
the two substrates are different, the product obtained consists of two symmetrical azo compounds and one asymmetrical azo compounds. The oxidizing coupling reaction of two amines used can be carried out by oxygen in the presence of a catalyst (CuCl/Pyridine) [76] under photocatalytic conditions promoted
by TiO2 [77], Fe2O3 [78] HgO [79] or oxidizing agents such as KMnO4 [80], MnO2 [81], NaBO3 [82], KO2 [83], K2FeO4 [84], AgO [85], Pb (OAc)4 [86]. The reduction reagents used are zinc or SnCl2 in a basic medium [87,88], LiAlH4 [89], ethylenediamine [90], Na2Te [91] or lead either with triethylammonium formate or acetate of ammonium [51,
52], Another method was published in 1906 which is based on the reaction of p-nitrophenol in an alkaline medium at 200 C [94]. According to Wglarz-tomczak [95], the reaction presented in the Figure 47 could yield a reasonable yield of the azo compound due to their application conditions by heating the substrates used in KOH/DMF solution for 1248
h at a temperature of 150 C under a nitrogen atmosphere [96,97]. Previously, a shorter time and a lower temperature did not allow productivity to be less than 20 % [97,98]. Azo compound. The simplest reaction in the synthesis of azo dyes. This reaction can be carried out
by three different methods [99,100], (Figure 49). Synthesis of nitrosated derivatives. Subsequently, the amino and nitroso substrates are simply mixed in glacial acetic acid at room temperature [101]. A modification of this method involving the in situ generation of the nitroso derivative from the starting amine under the action of H2O2 and its
subsequent reaction with an unoxidized reagent can lead to the symmetrical product [102]. Figure 50 shows an electrophilic aromatic system substituted by an electron donor group (OH, NH2 or their derivatives) is the
corresponding nucleophile [89,103]. Electrophilic aromatic substitution mechanism. The coupling reaction can take place when an alkyl-substituted aromatic derivative which is the nucleophilic reagent, in which case the electronic deficit of the
diazonium group. This allows the coupling of 2, 4, 6-trinitroaniline with 1, 3, 5-trimethylbenzene, 1, 2, 3, 5-tetramethylbenzene or pentamethylbenzene [103,104]. Typically, the diazonium salt received is immediately subjected to the coupling reaction, because after separation and drying become explosive [105]. In the reaction of diazonium salts with
phenols, the product is substituted in the para position with respect to the hydroxyl group. If this site is occupied, the ortho isomer is obtained. In the case of unsubstituted aniline, an azo aminobenzene compound is preliminarily formed (-N=NNH-) and then rearranged to the mixture of the para and ortho isomers of the amino azobenzene product
[106]. To avoid this disadvantage, protection of the amino group can be applied for coupling and eliminated after the reaction, for example, by hydrolysis [107]. The direct method of obtaining the amino azobenzene structure (avoiding rearrangement) is thus to effect the reaction in formic acid and sodium formate [108]. New generations of azo dyes
 have been synthesized by different synthetic methods, [109,110,111,112]. In this part we have cited some syntheses of the azo dyes can be theoretically included in azo-hydrazone tautomerism which is a very
important propertie in the industrial application of the azo dyes [56]. The physical (solution and solid) states of the azo-hydrazone tautomery are of theoretical and practical interest because the two tautomery are of theoretical and practical interest because the two tautomery are of theoretical and practical interest because the two tautomery are of theoretical and practical interest because the two tautomery are of theoretical and practical interest because the two tautomery are of theoretical and practical interest because the two tautomery are of theoretical and practical interest because the two tautomery are of theoretical and practical interest because the two tautomery are of theoretical and practical interest because the two tautomery are of theoretical and practical interest because the two tautomery are of theoretical and practical interest because the two tautomery are of theoretical and practical interest because the two tautomery are of the azo-hydrazone tautomery a
ethylthio-5-cyanomethyl-4-phenyl-1,2,4-triazole (1) with benzene diazonium chloride 2 and then coupling of the diazonium salt with compound 1 in an aqueous solution of ethanol in the presence of a buffered solution of sodium acetate. This reaction yields 5-ethylthio-N, 4-diphenyl-4H-1, 2, 4-triazole-3-carbohydrazonoyl (3B) with excellent yield. The
dye prepared can exist in three possible tautomeric forms, The azo form A, the hydrazone form B and the azo-enamine form C, (Figure 51). Compound 1 coupling reaction with benzene diazonium salt on the equilibrium between the
three forms A, B, and C is taken into account. A study was made by Pavlovi etal. [117], which reported that the electron-withdrawing groups promote the content of the hydrazone form. In accordance with these results, we have
succeeded in predicting that the coupling reaction of compound 1 with diazotized 4-methylaniline 4 under similar reaction conditions to the above gives 5-ethyl-thio-3- (1- (4-methylaniline.While the coupling reaction of the
diazonium salts induces electron withdrawing substituents in the para position of the benzene ring with compound 1. Surprisingly, Compound 1 was coupled to the diazotized 4-chloroaniline 6 in the same Reaction conditions above it gives two tautomers, 7A (major product), (Figure 53). Coupling reaction of 1 with diazotized 4-chloroaniline 6 in the same Reaction conditions above it gives two tautomers, 7A (major product) and 8B (minor product), (Figure 53).
chloroaniline. According to Mirkovi et al. [56], the arylazo pyridone dyes were synthesized by two routes following the reaction sequence below, (Figure 54). Synthesis of arylazo pyridone dyes were synthesized by two routes following the reaction sequence shown in Figure 55,
[118,119,120]. New azo hydrazone tautomerism in azo dyes. Figure 56 shows different possibilities of the structure of 1a-1e. Shows different possibilities of the structure of 1a-1e. Shows different possible tautomeric models, as shown in Figure 57. Possible tautomeric structures
of dye 1a. The possible tautomeric structures of dyes 1b-1e are shown in Figure 58. Possible tautomeric forms of prepared dyes 1b1e. According to kamazani et al. [113], this dye was obtained by the diazotization of the substituted aniline and the coupling reaction of 2-hydroxybenzaldehyde, (Figure 59). Synthesis of azo-chromene. Figure 60 shows
different possible dye a structure of compound A.Badrey et al. [115], have been reported that the synthesize of azo dyes based on 2-amino-7-hydroxy-4-phenyl-4H-chromene-3-carbonitrile [124,125] has been reached by two routes. 2-amino-7-hydroxy-4-phenyl-4H-chromene-3-carbonitrile was
coupled to various diazonium salts which make it possible to obtain the corresponding dyes and then react with cyanuric chloride, (Figure 61). Synthesis of reactive azo dyes from 2-amino-7-Hydroxy-4-phenyl-4H-chromene-3-carbonitrile through various alternative routes. According to Hallas et al. [70], the following sequence represents the synthesis of
azo dyes derived from 2-aminothiazoles, (Figure 62). Synthetic routes to some azo dyes from 2-aminothiazole. Figure 63 and 64 illustrating different structure of compound IV. Different structure of compound V. These
dyes are the most diverse group of all synthetic dyes (-N=N-) they are widely used in the fields of pharmacological activities [123], biological [2,124], in high-tech applications such as lasers and nonlinear optical systems [125], thermal transfer printers and fuel cells [126]. Also sensitized to
solar cells [127], photodynamic therapy [126], metallochromic indicators [128], dyeing of textiles [129], leather, paper, food [130,131,132,133], cosmetics [7,134] and medicines [128], dyeing of textiles [129], leather, paper, food [130,131,132,133], cosmetics [7,134] and medicines [128], dyeing of textiles [128], dyeing of text
number of biological reactions such as DNA inhibition, RNA and protein synthesis, carcinogenesis and nitrogen fixation, [137]. Furthermore, the azo dyes are characterized by their physicochemical stability [138] and optical properties [139,140] with various applications in liquid crystals [141] and the nanotubes [142]. In recent years, azo-
functionalized dyes bearing aromatic heterocyclic compounds have attracted increasing attention due to their wide range of colors, luminosity, the simplications of azo dyes such as azo-polymer conjugation. The types
of bond which favor this conjugation can be covalent or non-covalent [146]. The preparation of polymeric dyes for technical and industrial applications is mainly carried out by the polymers since the corresponding materials contain a higher dye
concentration. Then, a tinctorial resistance is higher than the molecular weight derivatives of the unique chromophores [147]. As reported in [148], the modification of dye containing polymers. The general procedure is
illustrated in Figure 65 [149]. Diagram of the preparation of colored monomers. A synthesis was performed by azo coupling of 6-(methyl (phenyl) amino) hexan-1-ol and a 4-nitrobenzenediazonium salt. Subsequently, this methacrylate dye was treated with acryloyl chloride and meth acryloyl chloride.
Copolymerization with methyl methacrylate as well as homopolymerization of each coloring monomer gave linear soluble polymers. These dyes are commonly used in materials applied in nonlinear optics [150]. Another example is the performance of azo coupling with N-aryl maleimides for the generation of polymerizable azo polyester radicals
[140,141]. For the preparation of structurally different azo dyes, 2, 6-dibromo-4-nitroaniline and 2-amino-3, 5-bis (ethoxy carbonyl)-4-methylthiophene have been converted into the corresponding diazonium salts (Figure 66), [152]. Synthesis of an azo dye bearing N-aryl maleimides and their free radicals of polymerization. These were then coupled with
several N-aryl maleimides giving the desired coloring monomers which readily polymerize under free radical conditions. The preparation of a methacrylate-based azo dye monomer in three reaction steps was addressed in another study (Figure 67), [151]. In the first step, tyramine was methacrylate by treatment with methacrylic anhydride.
Subsequently, the diazotization of 3-aminopyridine was carried out. The product obtained therefrom is then coupled to the methacrylate tyramine. The resulting azo dye monomer was incorporated into polymers by copolymerization with N, N-dimethyl acrylamide. In addition, the copolymer has been studied with regard to its complexing behavior in
the presence of copper ions [153]. Synthesis of a derivative of polymerizable azo dye. Dye-polymer backbone which can readily react with small molecule functional groups. Figure 68 shows the mechanism for binding a molecule of the dyes to a polymer [154,155]. Fixing
molecule of the dye on polymer. These molecules can be dyes themselves or a constituent element established by several steps and by fixing a chromophore. Depending on the molecular structure of the dye and the nature of the dye and the molecular structure of the dye and the nature of the nature of the dye and the nature of the nature of
synthesized from the copolymerization of poly (N-isopropyl acrylamide and N-acyloxy succinimide), which gave linear polymers bearing active ester side groups. These were reacted with a catalysts, including a colored "phase label [155]. In general,
to preformed polymers, several varieties of examples of attachment of azo dyes have been published [151]. It has been observed that poly-electrophiles such as poly (epichlorohydrin) and poly (chloromethyl styrene) make it possible to attach nucleophilic building blocks which can be further converted into azo dyes, but the problem with these
compounds is their tendency to Crosslinking. By using polymorphonuclear agents, the effective fixation of N-acetylsulfanilyl chloride has demonstrated poly (vinylamine). The polymeric azo dyes were then obtained by the deprotection and diazotization of the sulfanilic acid fractions followed by azo coupling with a sufficient aromatic amount
(Figure 69), [151]. Step-wise fixing of an azo dye to poly (vinylamine). Non-covalent binding can occur through different types of interactions such as ion dipoles, dipole interactions and inclusion complexes, and so on. Dye - Sugar-based polymers are a large number of polar substituents that enable the formation of dipolar interactions with
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