Review Article

The Azo Derivatives of Salicylic Acid

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ABSTRACT

Azo dyes are extremely important in variety of industries for variety of technical purposes. The compounds containing azo grouping are most widely used as synthetic colorants. Azo dyes are generally synthesized starting from primary aromatic amines by diazotization and coupling with e.g. phenols or primary aromatic amines or their carboxylic derivatives such as salicylic acid etc. The chemical structures of synthesized compounds were studied for confirmation of structure using varied type of analytical data and the spectroscopic techniques like UV-Visible, FTIR, Mass spectra, ^{1}H- and ^{13}C-NMR. These compounds have numerous applications such as antioxidants, as pigments, the polymeric biodegradable prodrugs and many pharmacological uses.

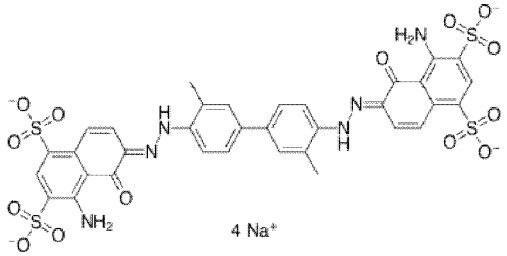
Keywords: Azo dyes; salicylic acid derivatives, coupling reaction; diazotization.

INTRODUCTION

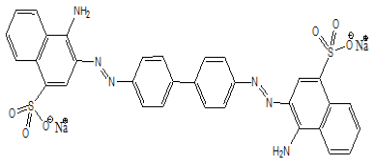
Azo compounds or dyes are characterized by the presence of the azo moiety (–N=N–) in their structure, conjugated with two, distinct or identical, mono- or polycyclic aromatic or heteroaromatic systems. Because of their specific physico-chemical properties and biological activities, they have found a broad application viz in pharmaceutical, cosmetic, food, dyeing or textile industry and analytical chemistry. However, the most typical and popular field of utility remains as their coloring function. Azo dyes are the largest and the most versatile class of dyes.

The azo compounds are applicable for biocidal treatment of textile materials because they exhibit biological activity[1]. Azo compounds are well known for their medicinal importance and are recognized for their applications as antidiabetics[2], antiseptics[3], antineoplastics[4], antibacterial[5-6] and antitumor[7]. They are involved in a many biological reactions such as inhibition of DNA, RNA, carcinogenesis, protein synthesis and nitrogen fixation[8,9]. Azo compounds are valuable in the medicinal and pharmaceutical fields[10] and probably the azoimine linkage might be responsible for the biological activities displayed by some Schiff bases as reported[11-12].

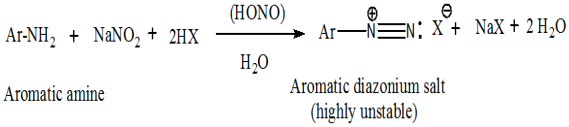
The azo compounds viz. Evans blue, **1** and Congo Red, **2** are being studied as HIV inhibitors of viral replications[13]. The existence of azo moiety show antibacterial and pesticidal activities. Recently, azo group containing compounds as antimicrobial agents has been the subject of study reported by H. N. Chopde[11], A. H. Shridhari[14] and C. J. Patil[15-17]. Synthesis of most azo compounds involves diazotization of a primary aromatic amine, followed by coupling with one or more nucleophiles. Thus, benzoic, phenolic, salicylic and naphtholic compounds undergoes diazotization reactions. Because of variety applications, azo compounds, it is interesting to study synthesis of such salicylic azo compounds and their derivatives in order to explore the newer potentials of such compounds. Few times azo compound is often described as a chromogen in the literature[18]. The amino-and hydroxy-groups are commonly used coupling components[19]. The emergence of diverse classes of synthetic dyes including azo dyes occurred due to constant effort to find specific dye for application in diverse materials of industrial importance which include, but not limited to textile fabric[20], ink-jet printer, paper, leather, aluminium sheet[21]. Furthermore, azo compounds also have a many applications in photo-industry such as photodynamic therapy, photographic or electro-photographic systems and are dominant organic photoconductives[7,14].



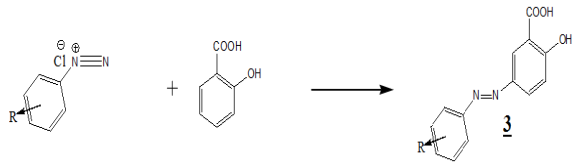
1 Evans Blue



2 Congo Red



Scheme-1: General Reaction Mechanism of Diazonium Salt formation.



Scheme-2: Coupling Reaction with Salicylic acid.

Literature Survey and Discussion:

In the last century, azo compounds constitute one of the largest classes of industrially synthesized (including natural pigments) organic compounds, potent in drug and the cosmetics[22-23]. Segmented polyurethanes containing azo aromatic groups in the main chain were synthesized by reaction of 3,3'-azobis(6-hydroxybenzoic acid) (ABHB), 5-[4-(hydroxyphenyl)azo] salicylic acid (HPAS), and 5-[1-hydroxynaphthyl)azo] salicylic acid (HNAS) with hexamethylenediisocyanate (HDI). All the studied azo polymers showed good thermal have decomposition temperature above 195 °C[24]. The p-aminobenzoic acid and its salicylic acid derivatives (PAS) are bacteriostatic and decrease the respiration of tubercle bacillus (antitubercular drugs). PAS is preferred to the other benzoates or salicylates as it is less toxic and it prevents rapid development of resistant strains. It is more effective when it is given in combination with streptomycin fever during the administration of salicylate signals for the discontinuation of the drug immediately[25].

The azo dyes based on salicylic acid-formadehyde polymer as a polymeric ligands were used to form metal chelates with Cu^{+2}, Zn^{+2}, Co^{+2}, Fe^{3+}, UO_2^{2+}, $Mn^{+2}$and Ni^{+2}. The ion-exchange and antibacterial and antifungal properties of these polymers were also studied. The colours of azo dyes include different shades of yellow, red, orange, brown, and blue and hence used as an indicator compounds[26].

Few azo compounds are pharmaceutically acceptable salts and process for preparing the 2-[(p-(2-pyridylsulfamoyl)phenyl)azo]hy droxybenzene; 3-[(p-(2-pyridylsu1famoyl)phenyl)azo] salicylic acid; and 5-[(p-(4-(2-pyridylanilino))-N phenyl)azo]salicylic acid[27].

Azo compound represents the largest class of dyes, their breakdown products are toxic and or mutagenic to life. They are studied for evaluation of their resistance against the growth of fungi organisms, antihelmentic properties and dyeing abilities on cotton fabrics, biodegradation of different azo compounds and anaerobic property[28]. Azo-Bis salicylic acid and its salt which are useful on the treatment of inflammatory conditions of the intestine[29]. From methyl salicylate and 2-amino-2-(hydroxymethyl)propane-1,3-diol, or 2-amino-2-methylpropane-1-ol, the 2-oxazoline derivatives as well as mono and bis-derivatives of salicylic acid and biological activity were reported. Reactions using microwave irradiation in the presence of PTC (tetrabutylammonium bromide) or metallic sodium as catalyst, as well as by conventional heating were reported. Some of the mono- and bis-salicyloyl derivatives were transformed to the corresponding phenyl-azo derivatives. The antioxidant and cytotoxic activities of the synthesized derivatives were evaluated in a series of *in vitro* tests. compounds inhibited growth of MDA-MB-231 cells at a nanomolar concentration showed high cytotoxicity against MCF7 cells, whereas compounds showed high activity against K562 cells[30].

Iron complexes of reactive azo dyes were studied by R. Hrdina[31]. A set of reactive mordant azo dye compound was prepared by diazotization of aromatic amines and their subsequent coupling reaction with secondary components. Dyed wool samples were treated (mordanted) with iron salts Fe(II), Fe(III) and a chromium salt (CrF_3). The iron mordant dyeing showed acceptable wash fastness and light fastness comparable with chromium complexed dyes[31], reactive dyes, iron mordant dyes, wool, wash fastness, light fastness.

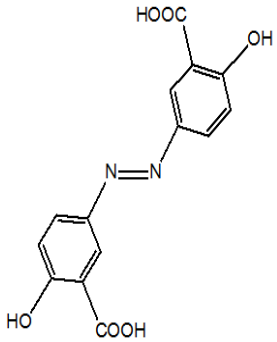
B. K. Patel[32] have synthesized five sulfanilamide derivatives. Then all sulfanilamide derivatives diazotization with $NaNO_2$ and HCl at 0-5°C. Then the azo dye was synthesized by the coupling of diazonium salt of sulfanilamide derivatives with salicylic acid ligand. After the synthesis, compounds were characterized by chemical as well as instrumental methods, like melting point, elemental analysis, UV-visible spectroscopy and IR spectral studies.

Ewelina[33] has proposed that azo dyes – a fatal threat or a new generation of drugs? In 1858 Griss developed the azo coupling reaction and obtained first azo dye–Aniline Yellow. Nowadays, around 10,000 of these compounds are described and more than 2000 are applied to color various materials. Azo dyes are characterized by the presence of the azo moiety (–N=N–) in their structure, conjugated with two, distinct or identical, mono- or polycyclic aromatic systems. Because of their specific physico-chemical properties and biological activities, they have found a broad application in pharmaceutical, cosmetic, food, dyeing or textile industry and analytical chemistry. However, the most typical and popular field of utility remains their coloring function. Azo dyes are the largest and the most versatile class of dyes. They possess intense bright colors, in particular oranges, reds and yellows. In addition, azo dyes exhibit a variety of interesting biological activities. Medical importance of these compounds is well known for their antibiotic, antifungal and anti-HIV properties. On the other hand they bring a certain danger for health and environment because of cancero- and mutagenicity. In this review, selected synthetic strategies and biological activities of azo dyes are presented, the latter in the context of a therapeutic potential and a hazard connected with their production and application.

H. H. M. Abdull-Allah[34] have synthesized from salicylicacid and phenyldiazoniumchloride salt, 3-N-(4`-Hydroxy-3`-substituted phenyl)carbamoyl-1-methylpyridinium iodide

derivatives and 3-carbamoyl-1-(N-(4`-hydroxy- 3`-substituted phenyl)carbamoyl) methyl pyridinium chlorides were synthesised and tested some of them for their analgesic and antiinflammatory activities by hot plate test and carageenin-induced hind paw edema model, respectively. 3-N-(4`-hydroxy-3`-substituted phenyl)carbamoyl-1-ethylpyridinium iodides revealed the most potent analgesic and anti-inflammatory activities in comparison to sulfasalazine and 5-ASA. In addition, ulcerogenicity, LD 50, in-vivo and in vitro cleavage and pH stability of 3-N-(4`-hydroxy-3`-substituted phenyl)carbamoyl-1-methylpyridinium iodides were also determined.

Lamber and Pitzele[35] have mentioned in the present invention relates to novel compounds and a method for the prophylaxis and treatment of Inflammatory Bowel Disease (IBD) via the administration of an effective amount in a suitable pharmaceutical dosage form of an azobenzene compound **4** or a pharmacologically acceptable salt, which is reductively cleaved to 5-aminosalicylic acid (5-ASA) by bacteria in the large intestine.

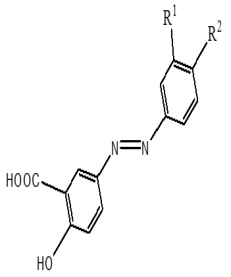


Popa[36] have studied three dyes, as concentration in the paint grows, the luminosity gets fainter and thrown light on the coloring power of this class of compounds by studying the colour properties of some azoic dyes derivates of salicylic acid. The one containing nitrogen at the coupling component provides a higher luminosity than the dyes, which also contain sulphur. From the two dyes containing sulphur, the one with a supplemental benzene nucleus is less luminous. This behaviour is due to strengthen of aromatic conjugation, which causes a bathocroma displacement, thus a darkness in colour as an outcome of decreasing luminosity. The dye containing only nitrogen at the coupling component tends to provide in visual perception more red, in direct ration to concentration. The dye with a stronger conjugation of the coupling component tends to provide less red at high concentrations, which means a shifting towards green in the colour space. The dye containing a coupling component with nitrogen provides more yellow compared to sulphur containing dyes. The samples are different regarding their dye concentration. The hue, luminosity and saturation are studied as well as their colouring power. The colouring power of all three dyes is strong, which makes them very efficient in industrial use.

Bernt Jabes Lindberg[37] have studied amine addition salts of 5-[p-'(2-pyridylsulfamyl)-phenyl azo J-salicylic acid are provided. The amine-is represented, by the formula: **A-R** wherein **A** is either $-NR_1R_2$ or 4-morpholino, or piperidino; and wherein **R** is either tris-hydroxymethyl-methyl, 2-hydroxy ethyl, 2-hydroxypropyl, 3-hydroxypropyl, 2-methoxyethyl, 3,4,5,6-tetrahydroxyhexanal-2-yl, and 2,3,4,5,6-pentahydroxyhexyl; and R_1 and R_2 (pl see **Table-1** for values) are either hydrogemmethyl, ethyl, or 2-hydroxyethyl. The present compounds can be used for the treatment of ulcerative colitis and rheumatoid.

Reddy[38] have stated two simple, sensitive, accurate and economic methods have been developed for the quantitative estimation of mesalamine and its formulations. **Method-A** is based on the diazotization of primary amine group of mesalamine with sodium nitrate and hydrochloric acid followed by coupling with resorcinol to form a orange colored chromogen with a characteristic absorption maximum at 460 nm. **Method-B** is based on the reaction of the mesalamine with vanillin in acidic medium producing Schiff s base having absorption maximum at 395 nm. The methods were successfully applied to the determination of mesalamine in pharmaceutical formulations.

Henry Mirocourt[39] has used azo dyes and ortho-oxy-azo dyestuffs for synthesis of complexes of chromium. Garjani[40] have synthesized Three azo prodrugs; 4,4 -dihydroxy-azobenzene-3-carboxilic acid **5**, 4-hydroxy-azobenzene-3,4-dicarboxilic acid **6**, 4,4-dihydroxy-3-formyl-azobenzene-3-carboxylic acid **7**,and their polyethylene glycol (PEG 6000) derivatives were synthesized and demonstrated the effect and relation of protective and anti-inflammatory effects of azo and azo-linked polymeric prodrugs of 5-aminosalicylic acid (5-ASA) on acetic acid induced colitis in rats are investigated. Results of their investigation provide experimental evidence supporting new cytoprotective, anti-inflammatory and anti-edema properties of the azo derivatives of 5-ASA and their PEGylated prodrugs.



5 R_1=H, R_2=OH;

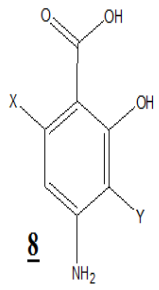
6 R_1=H, R_2=COOH; and

7 R_1=CHO, R_2=OH.

For decades, sulphasalazine, an azo-compound derived from sulphapyridine and 5-aminosalicylic acid (5-ASA), has been the only valuable non-cortico-steroid drug in the treatment of inflammatory bowel disease[41]. Literature[42] showed that the pharmacologically active moiety in sulphasalazine for the treatment of these diseases was 5-

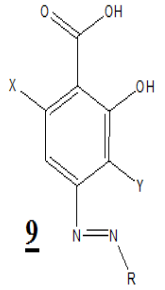
ASA. Moreover, it has been shown that the metabolite sulphapyridine was largely responsible for the side-effects of sulphasalazine[41]. Consequently, this resulted in a number of new 5-ASA formulations (mesalazine, olsalazine, balsalazine) for topical and oral use. 5-ASA is partially resorbed, particularly in the acetylated form and eliminated as such in the urine. The colon is the predilected place for this acetylation since in the small bowel there is a lack of the responsible bacterial flora. Hence, 5-ASA is readily absorbed as such in the small bowel. How far this may form a rationale for a possible difference in nephrotoxicity for the different preparations remains scope for research.

Herbert Kracker[42], have reported study of the 4-Amino-2-hydroxybenzene-1-carboxylicacid, where X and Y may be equivalent to H or other substituent. These, **8** type of compounds are used to synthesized valuable azo-dye stuffs. The compounds of the type **8** can be coupled with varied phenolic compounds (like salicylic acid, naphthol sulphonic acids and amino naphthol sulphonic acids etc.) and converted to compounds of type **9**, are used as azo-dye stuffs as well.



8

4-Amino-2-hydroxybenzene-1-carboxylicacid



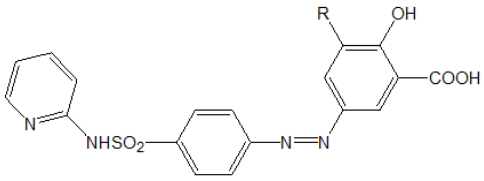
9

Substituted-4-azo-(3,6-disubstituted-2-hydroxybenzene)-1-carboxylicacid

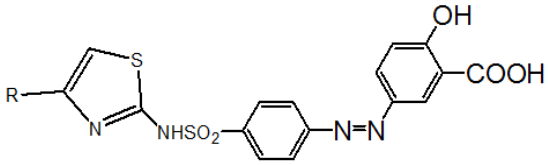
Such compounds improve the fastness property of the dye-stuff or can be applied to fiber directly depending upon the group attached to the molecule. In the present patent there are primary mistakes in nomenclature of the compounds in the Table they have given therein. So it is not correct, that criticize the same.

J. A. Jalani[43], the syntheses of 4-aminophenylbenzoxazol-2-yl-5-acetic acid, (an analogue of a known nonsteroidal anti-inflammatory drug [NSAID]) and 5-[4-(benzoxazol-2-yl-5-acetic acid)phenylazo]-2-hydroxybenzoic acid (a novel mutual azo prodrug of 5-aminosalicylic acid [5-ASA]) are reported. The structures of the synthesized compounds were confirmed using infrared (IR), hydrogen-1 nuclear magnetic resonance (^{1}H NMR), and mass spectrometry (MS) spectroscopy. Incubation of the azo compound with rat cecal contents demonstrated the susceptibility of the prepared azo prodrug to bacterial azoreductase enzyme. The azo compound and the 4-aminophenylbenzoxazol-2-yl-5-acetic acid were evaluated for inflammatory bowel diseases, in trinitrobenzenesulfonic acid (TNB)-induced colitis in rats. The synthesized diazo compound and the 4-aminophenylbenzoxazol-2-yl-5-acetic acid were found to be as effective as 5-aminosalicylic acid for ulcerative colitis. The results of this work suggest that the 4-aminophenylbenzoxazol-2-yl-5-acetic acid may represent a new lead for treatment of ulcerative colitis.

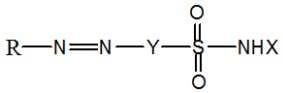
Eric Emil[44] have reported following heterocyclic sulphonamido azo compounds **10**(a, b, c) and . The molecule **10**a and **11**a forms water soluble salt with alkali.



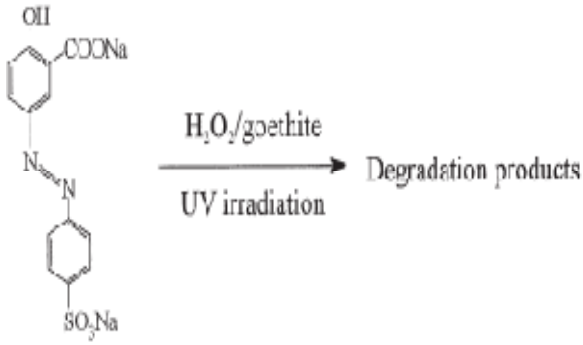
10 a) R = -H; b) R = -CH_3 c) -COOH



11a) R = -H and b) R = -CH_3.

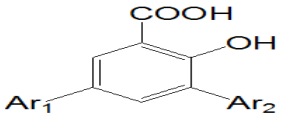


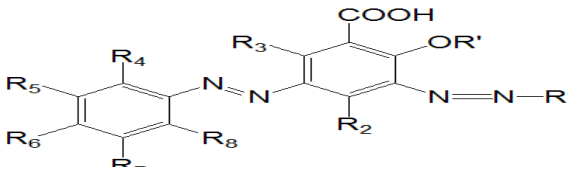
The photodegradation of Mordant Yellow 10 (MY10), a kind of azo dye, in aqueous dispersions of H_2O_2/hematitc (alpha-Fe_2O_3), goethite (alpha-FeOOH) and akaganeite (beta-FeOOH) at neutral pHs under UV-light irradiation was examined. The fastest degradation rate of MY10 was obtained with goethite, the reports made by Ju He[45].



The formation of OH in the photoreaction process was detected by ESR spin-trapping technique. A possible mechanism of heterogeneous photo-Fenton reaction was proposed by Ju He[45].

Table 1: The Skeleton, Substituent's position and Applications of the azo moiety containing compounds from Salicylic acid.



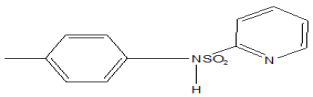


No.	R'	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	Ref	Application	R"	R‴
	Ar-N=N-Ar-N=N-Ar												
1	H	H	H	H	H	H	-OH	H	H	24	As polymeric biodegradable prodrug	-	-
2	H	H	H	H	H	COOH	-OH	H	H				
3	H	H	H	H	H	H	-OH	$-C_4H_4-$					
4	link-	H	H	H	H	-COOH	-O-C=O-NH-link		H				
5	link-	H	H	H	H	H		H	H				
6	link-	H	H	H	H	H		$-C_4H_4-$					
7	-	H	H	H	H	H	$-SO_3H$	H	H	25	The colours of azo dyes include different shades of yellow, red, orange, brown, and blue used for textile		
8	-	H	H	H	H	H	H	H	$-SO_3H$				
9	-	H	H	H	H	H	NO_2	H	H				
10	-	$-CH_2$-5-CH_2-5-Sali	H	H	H	H	H	H	H	26	Studied for the chelation ion-exchanging properties of the polymers	-	-
11	-	$-CH_2$-5-Sali-5-Sali	H	H	H	H	H	H	H				
12ψ	-	H	H	H	H	H	$-NH-SO_2$-2-Py	H	H	27	Pharmaceutically acceptable and readily soluble salts	-	-
13*	-	-N=	H	H	-	-	-	-	-				
14	-	H	H	H	H	H	-NH-(-Ph-4)-2-Py	H	H				
15	-	H	H	H	H	H	$-NH_2$	H	H	28	Antifungal, antihelmentic activities and their dyeing ability	-	-
16	-	H	H	H	H	$-NO_2$	$-NH_2$	H	H				
17	-	H	H	H	CH_3	H	-OH	H	H				
18	-	H	H	H	$-CH_3$	H	$-NH_2$	H	H				
19	-	H	H	H	H	H	-OH	H	H				
20	-	H	H	H	H	$-NO_2$	-OH	H	H				
21	-	H	H	H	H	$-OSO_2R_2$	$-CO-O-R_1$	H	H	29	Inflammatory bowel diseases (IBD	-	H
22	-	H	H	H	H	$-OSO_2R_2$	$-CO-OR_1$	H	H			-	Me
23	-	H	H	H	H	$-OSO_2R_2$	$-CO-OR_1$	H	H			-	Et
24	-	H	H	H	H	$-OSO_2R_2$	$-CO-OR_1$	H	H			-	Pr
25	-	H	H	H	H	$-OSO_2R_2$	$-CO-OR_1$	H	H			-	But

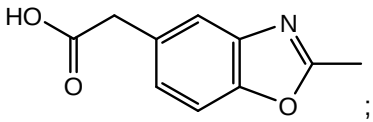
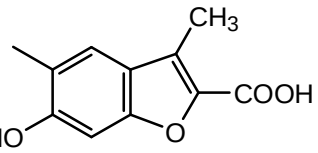
26	-	H	H	H	H	$-OSO_2R_2$	$-CO-OR_1$	H	H			-	Pent
27	-	H	H	H	H	H	H	H	H	30	Studied for antioxidant activities	$-NH-CH_2-CH_2-OH$	-
28	-	H	H	H	H	H	H	H	H			$-NH-(CH_2)_2$-Link	-
29	-	H	H	H	-OH	H	-OH	$-N=N-C_4H_4-RG_1$	H	31	Useful for wool dying	-	-
30	-	H	H	H	H	H	$-NH-SO_2$-Link	H	H				
31	H	-	-	-	H	H	$-SO_2-N-Et_2$	H	H				
32	H	-	-	-	H	H	$-SO_2-N-Ph_2$	H	H	32	The antioxidant, Antiproliferative and cytotoxic activities of the synthesized derivatives were evaluated in a series of *in vitro* tests.	-	-
33	H	-	-	-	H	H	$-SO_2-N-(Ph)Et$	H	H				
34	H	-	-	-	H	H	$-SO_2-N-H(2,4-Cl_2-Ph-)$	H	H				
35	H	-	-	-	H	H	$-SO_2-N-H(2,6-Cl_2-4-NO_2-Ph-)$	H	H				
36	-	H	H	H	H	-O-PEG	H	H	H	33	Anti-inflammatory and cytoprotective potency	-	-
37	-	H	H	H	H	H	H	H	H	34	Inflammatory bowel diseases (IBD) with minor side effects	-OH	-
38	-	H	H	H	H	H	H	H	H			-OMe	-
39	-	H	H	H	H	H	H	H	H			-OEt	-
40	-	H	H	H	H	H	H	H	H			-OPro	-
41	-	H	H	H	H	H	H	H	H			$-NH_2$	-
42	-	H	H	H	H	H	H	H	H			$-NHCH_3$	-
43	-	H	H	H	H	H	H	H	H			-NHEt	-
44	-	H	H	H	H	H	H	H	H			$-N(Me)_2$	-
45	-	H	H	H	H	H	H	H	H			Piperidino	-
46	-	H	H	H	H	H	H	H	H			Morphonilino	-
47	-	H	H	H	H	H	-OH	-COOH	H	35	In the treatment of (Inflammatory Bowl Disease) IBD	-	-
48	-	H	H	H	H	H	$-SO_2-NH-Py$	H	H				
49	-	H	H	H	H	H	$-NO_2$	H	H	36	Colour dye	-NH-1,2,4triazole	-
50	-	H	H	H	H	H	$-NO_2$	H	H			-NH-2sub-thiazole	-
51	-	H	H	H	H	H	$-SO_2-NH-Py$	H	H	37	In the treatment of ulcerative colitis and rheumatoid arthritus	-	-
52	-	H	H	H	-OH	H	-OH	H	H	38	Determination of mesalamine in pharmaceutical formulation	-	-
53	-	H	H	H	H	H	-OH	H	H	39	The products are applicable in industry for dyeing of animal textile fibres.	-	-
54	-	H	H	H	H	H	$-SO_3H$	$-C_4H_4-$					
55										40	Azo derivatives of 5-aminosalicylic acid and their pegylated prodrugs	-	-

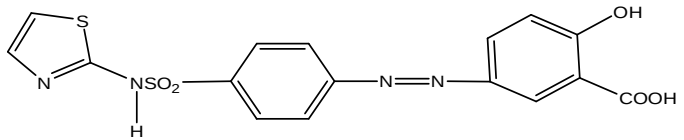
56	H	-	-	-	H	H	-SO_2-NH-Py	H	H	41	For the treatment of patients with chronic inflammatory bowl disease	-	-
57	As describe and disscued in the text									42	Used for synthesizing varied azo dyestuffs -	-	-
58	-	H	H	H	H	H	COOH	OH	H	43	It is for the water soluble azo dyestuff and for the navy-blue shades of good fastness properties.	-	-
	Het-Ar-N=N-Ar-N=N-Ar												
59	-	H	H	H	H	H	-SO_2-NH-Py	H	H	44	The colored powders with in general slight solubility in water and other usual solvents. In alkaline solution they will generally form more readily soluble salts having a stronger color	-	-
60	-	H	H	H	H	H	-SO_2-NH-Thizol-2-yl-	H	H				
61	-	H	H	H	H	H	-SO_2-NH-4-Me-Thizol-2-yl-	H	H				
62	-	Het-2-			H	H	-SO_2-NH-Py	H	H				
63	-	- Me	H	H	H	H	-SO_2-NH-Py	H	H				
64	-	-COOH	H	H	H	H	-SO_2-NH-Py	H	H				
65	H	H	H	H	H	H	SO_3Na	H	H	45	photodegradation of Mordant Yellow		

* for entry No. 13 R

= 

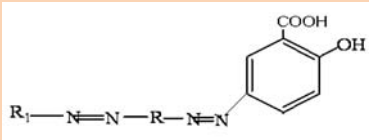
Gen. Abbrivations: Cl = Chloro-; Ph = Phenyl-; PEG = Propyl Ethylglycol ; Py = Pyridine; Pyl = Pyrrole; and

p-Het- =  ; **Het-2 =** 



2-Hydroxy-5-[4-(thiazol-2-ylsulfamoyl)-phenylazo]-benzoic acid

Table 2: The Skeleton, Substituent's position and Applications of the diazo moiety containing compounds from Salicylic acid.



Sr. No.	R	R1-	Ref	Application
1	Naphthyl-	1-Hydroxy naphthyl-4-sulfonicacid	42	Used for synthesizing varied azo dyestuffs.
2	2-Methy-5-methoxyphenyl-	2-Hydroxy naphthyl-3,6-disulfonicacid		

CONCLUSION

The compounds synthesized from the azo derivatives of salicylic acid are useful for many applications such as colours of azo dyes include different shades of yellow, red, orange, brown, and blue used for textile, for wool dying and in industry for dyeing of animal textile fibres, for the chelation ion-exchanging properties of the polymers. Pharmaceutically acceptable and readily soluble salts, polymeric biodegradable prodrug, antifungal, antihelmentic activities and their dyeing ability, Inflammatory bowel diseases (IBD), for antioxidant activities. In alkaline solution they will generally form more readily soluble salts having a stronger color. Azo derivatives of 5-aminosalicylic acid and their pegylated prodrugs.

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