Available online on 15.04.2020 at http://ajprd.com

Asian Journal of Pharmaceutical Research and Development

Open Access to Pharmaceutical and Medical Research

Open Access Research Article

Synthesis, Characterization and Antioxidant Activity of 2-Aryl Benzimidazole Derivatives

Vineet Kumar Singh, Amrita Parle

Department of Pharmaceutical Chemistry, Delhi Institute of Pharmaceutical Sciences and Research, Pushp Vihar sector III, New Delhi-110017.

ABSTRACT

Objective: To synthesize benzimidazole derivatives, characterize them by ^{1}HNMR and ATIR techniques and evaluate their antioxidant activity.
Methods: In the present study 19 benzimidazole derivatives were synthesized by reacting *O*-phenylenediamine as the primary reactant with different aromatic aldehydes and benzoic acids. Reactions were monitored using thin layer chromatography technique, and the newly synthesized derivatives were characterized by ATIR and ^{1}HNMR techniques. The antioxidant assay was performed using ABTS [2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid)] method and DPPH [2,2-diphenyl-1-picrylhydrazyl] method.
Results: Compounds BNZ-1, BNZ-2, BNZ-3, BNZ-9, and BNZ-10 showed comparable antioxidant activity to ascorbic acid at higher dose.
Conclusion: The synthesized benzimidazole derivatives have significant radical scavenging potential.

Keywords: Antioxidant, benzimidazole, *O*-phenylenediamine, Polyphosphoric acid

ARTICLE INFO: Received 09 July. 2019; Review Completed 25 August 2019; Accepted 10 Sept. 2019; Available online 15 April . 2020

Cite this article as:

Vineet Kumar Singh, Department of Pharmaceutical Chemistry, Delhi Institute of Pharmaceutical Sciences and Research, Asian Journal of Pharmaceutical Research and Development. 2020; 8(2):35-44.
DOI: http://dx.doi.org/10.22270/ajprd.v8i2.658

***Address for Correspondence:**

Singh V K, Parle A, Synthesis, Characterization and Antioxidant Activity of 2-Aryl Benzimidazole Derivatives

INTRODUCTION

Free radicals are unstable/unpaired electrons in their outermost shell and may become highly reactive.[1] Reactive oxygen species (ROS) are generated from molecular oxygen/nitrogen through Electron Transport Chain (ETC), cytochrome P450, and other cellular, sub-cellular functions.[2] Free radicals play an important role in a cell's life and death.[3] They affect beneficial metabolic and cellular processes adversely and play a key role in the development of pathological conditions of the body likes cell damage and homeostatic disruption causing diseases including diabetes, cirrhosis, cancer and cardiovascular diseases In healthy individuals,[4]it is normally balanced by the endogenous antioxidant system.[5] If the endogenous antioxidants fail to overcome the production of the reactive oxygen species, then exogenous antioxidants would be necessary to balance redox status.[6] All antioxidants generally influence the redox status, thereby protecting cells against Reactive Oxygen Species (ROS).[7] Antioxidants are molecules that help to protect cells from oxidative stress.[8] Antioxidants are either present naturally in various types of food (fruits and vegetables) or taken as dietary supplements.[9] They play a defensive role against ROS toxicity in our body. Thus antioxidants are considered as scavengers of free radicals.

Enzymes like Catalase, superoxide dismutase, glutathione peroxidase, and glutathione reductase directly/indirectly contribute to defense against the generated ROS. The non-enzymatic antioxidants like glutathione, vitamin E and C, uric acid, albumin, bilirubin, N-Acetylcysteine, melatonin are the scavengers of ROS and RNS actually.[10]

MATERIALS AND METHODS

Experimental

All chemicals and solvents were supplied by Sigma Aldrich, Merck, and CDH under a certificate of purity. The melting range of the synthesized compounds was measured by Scientech-2211 digital auto melting/ boiling point apparatus. Proton magnetic resonance (^{1}HNMR) spectra were recorded on Bruker 400 MHz NMR spectrometer using CDCl3 as a solvent. Chemical shifts were reported in parts per million relative to internal standard tetramethylsilane (TMS). IR spectra were recorded on Bruker-Alpha 1005151/06 ATIR spectrophotometer. Reaction progress was checked by TLC using Merck Silica

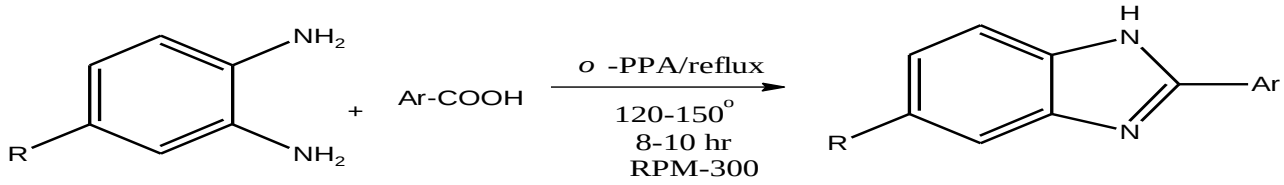
gel coated glass plates. The solvent system used was n-Hexane: Ethyl acetate in the ratio of 2:3.

Synthetic procedures:

By using substituted aromatic carboxylic acid and 5-substitued *O*-phenylenediamine:

0.01 mol. of 5-substituted-o-phenylenediamine was dissolved in toluene and stirred with heat till completely dissolved. This solution was taken in a round bottom flask (RBF). The Poly phosphoric acid was heated to 60°C and added slowly with stirring to 5-substituted-o-phenylenediamine solution. Finally 0.01 mol. of substituted aromatic carboxylic acid was added into the reaction mixture.RBF was fitted to reflux for about 8 to 10 hours at 120 to 150°C temperature at 300RPM.

To check the completion of reaction, TLC analysis of the compounds was done on Silica gel G 60 coated plates. The mobile phase used was n-hexane and ethyl acetate in the ratio of 2:3. The spots obtained were visualized in UV-chamber.



R= NO/ Cl/ H

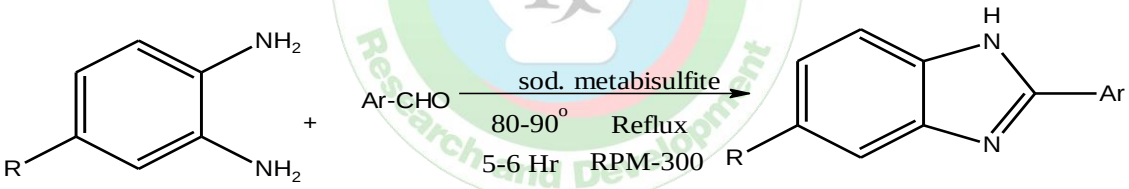
Ar= Aryl group

By using Substituted Aromatic aldehydes and 5-substituted-*O*-phenylenediamine

0.01 mol. of 5-substituted-o-phenylenediamine was dissolved in 30 ml of ethanol with continuous starring in RBF. Added 3.0 gram of Sodium meta-bisulfate in RBF. Finally 0.01 mol of substituted aromatic aldehyde was added in reaction mixture and fitted to reflux for 4 to 6 hours at the 80 to 90°C temperature and 300RPM.

To check the completion of reaction TLC analysis of the compounds was done on Silica gel G 60 coated plates. The mobile phase used was n-hexane and ethyl acetate in ratio of 2:3. The spots obtained were visualized in UV-chamber.

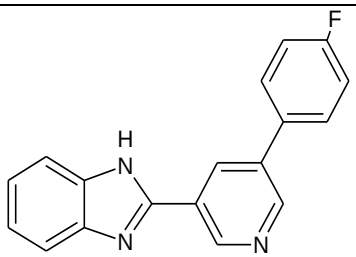
After completion of reaction, reaction mixture was cooled and to this ethyl ether was added to form a precipitate. The crude product was filtered and washed several times with ethyl ether until solid compound was obtained.

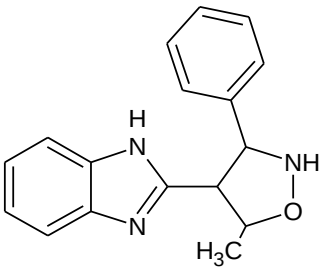
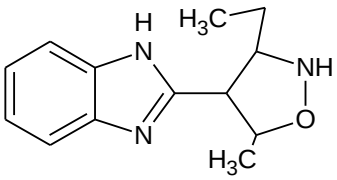
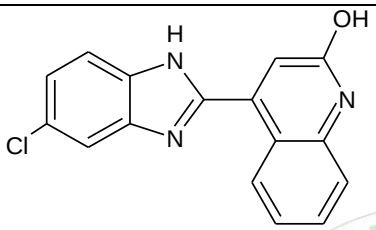
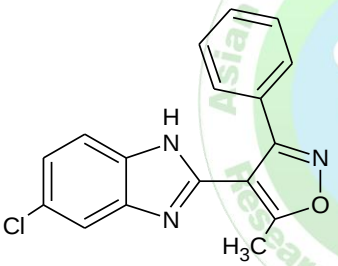
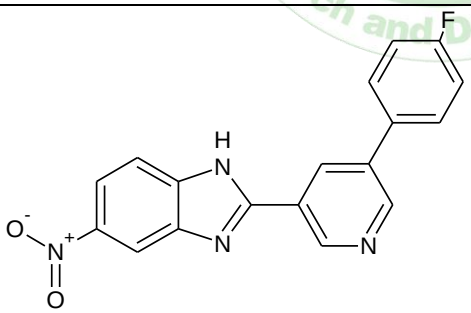
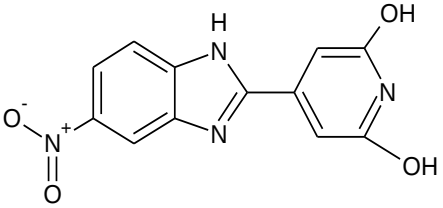


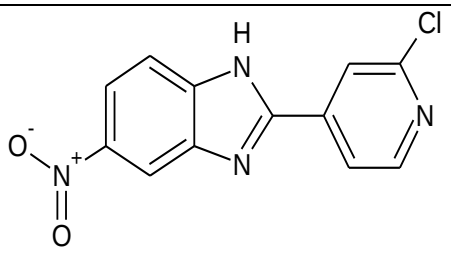
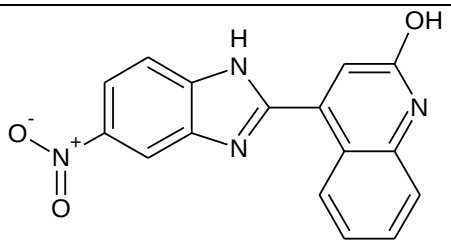
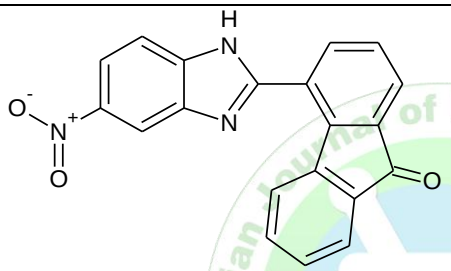
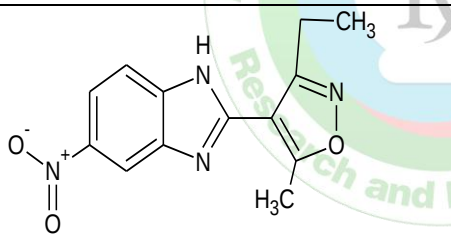
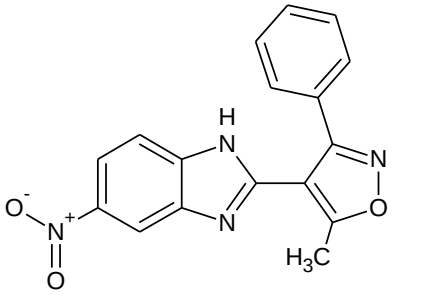
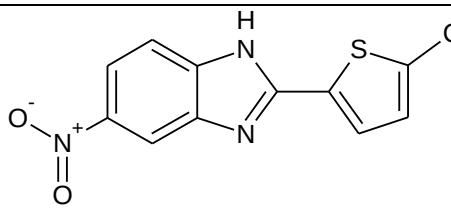
R= NO_2/ Cl /H

Ar= Aryl group

Table 1: List of synthesized compounds

Name	Structure	IUPAC Name
BNZ 1		2-[5-(4-fluorophenyl)pyridin-3-yl]-1*H*-benzimidazole

BNZ2		2-(5-methyl-3-phenyl-1,2-oxazolidin-4-yl)-1*H*-benzimidazole
BNZ3		4-(2,3-dihydro-1*H*-inden-2-yl)-3-ethyl-5-methyl-1,2-oxazolidine
BNZ4		4-(5-chloro-1*H*-benzimidazol-2-yl)quinolin-2-ol
BNZ5		5-chloro-2-(5-methyl-3-phenyl-1,2-oxazol-4-yl)-1*H*-benzimidazole
BNZ6		2-[5-(4-fluorophenyl)pyridin-3-yl]-5-nitro-1*H*-benzimidazole
BNZ7		4-(5-nitro-1*H*-benzimidazol-2-yl)pyridine-2,6-diol

BNZ8		2-(2-chloropyridin-4-yl)-5-nitro-1*H*-benzimidazole
BNZ9		4-(5-nitro-1*H*-benzimidazol-2-yl)quinolin-2-ol
BNZ10		4-(5-nitro-1*H*-benzimidazol-2-yl)-9*H*-fluoren-9-one
BNZ11		2-(3-ethyl-5-methyl-1,2-oxazol-4-yl)-5-nitro-1*H*-benzimidazole
BNZ12		2-(5-methyl-3-phenyl-1,2-oxazol-4-yl)-5-nitro-1*H*-benzimidazole
BNZ13		2-(5-methylthiophen-2-yl)-5-nitro-1*H*-benzimidazole

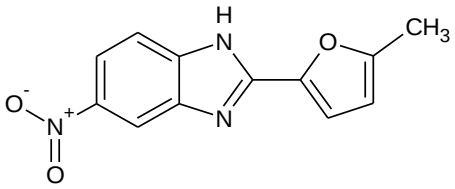
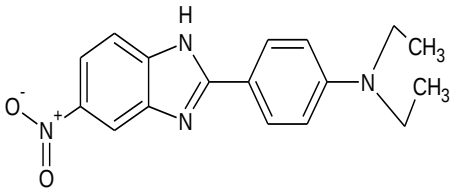
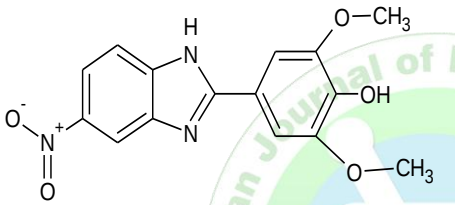
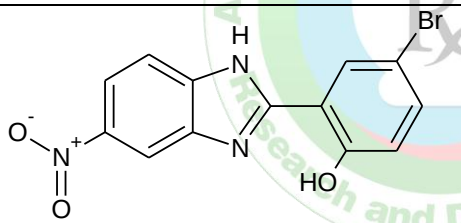
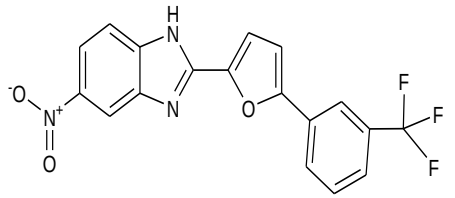
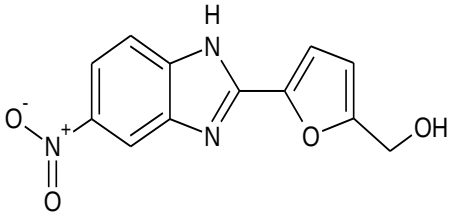
BNZ14		2-(5-methylfuran-2-yl)-5-nitro-1*H*-benzimidazole
BNZ15		*N*,*N*-diethyl-4-(5-nitro-1*H*-benzimidazol-2-yl)aniline
BNZ16		2,6-dimethoxy-4-(5-nitro-1*H*-benzimidazol-2-yl)phenol
BNZ17		4-bromo-2-(5-nitro-1*H*-benzimidazol-2-yl)phenol
BNZ18		5-nitro-2-{5-[3-(trifluoromethyl)phenyl]furan-2-yl}-1*H*-benzimidazole
BNZ 19		[5-(5-nitro-1*H*-benzimidazol-2-yl)furan-2-yl]methanol

Table 2: Physical data of synthesized compounds

Name	Molecular formula	Molecular weight	Melting point ^{0}C	Yield (%)	Solubility	state	Rf Value
BNZ 1	$C_{18}H_{12}FN_3$	289.28	185-187	74	Chloroform, DMSO, Ethanol, Methanol	Solid	0.90
BNZ2	$C_{17}H_{17}N_3O$	279.33	189-191	71	Chloroform, DMSO, Ethanol, Methanol	Solid	0.79
BNZ3	$C_{15}H_{21}NO$	231.33	184-186	73.5	Chloroform, DMSO, Ethanol, Methanol	Solid	0.82
BNZ4	$C_{16}H_{10}ClN_3O$	295.72	189-191	66	Chloroform, DMSO, Ethanol	Solid	0.90
BNZ5	$C_{17}H_{12}ClN_3O$	309.75	198-200	55	Chloroform, DMSO, Ethanol, Methanol	Solid	0.74
BNZ6	$C_{18}H_{11}FN_40_2$	334.33	196-198	74.2	Chloroform, DMSO, Ethanol, Methanol	Solid	0.79
BNZ7	$C_{18}H_8N_4O_4$	272.21	192-193	76	Chloroform, DMSO, Ethanol, Methanol	Solid	0.75
BNZ8	$C_{12}H_7ClN_4O2$	274.66	191-193	63	Chloroform, DMSO, Ethanol, Methanol	Solid	0.86
BNZ9	$C_{16}H_{10}N_4O_3$	306.27	206-208	68.4	Chloroform, DMSO, Ethanol, Methanol	Solid	0.70
BNZ10	$C_{20}H_{11}N_3O_3$	341.31	204-205	69	Chloroform, DMSO, Ethanol, Methanol	Solid	0.73
BNZ11	$C_{13}H_{12}N_4O_3$	272.25	188-190	64.6	Chloroform, DMSO, Ethanol, Methanol	Solid	0.66
BNZ12	$C_{17}H_{12}N_4$	320.30	207-209	62	Chloroform, DMSO, Ethanol	Solid	0.88
BNZ13	$C_{12}H_9SN_3O_2$	259.28	201-203	67.4	Chloroform, DMSO, Ethanol, Methanol	Solid	0.66
BNZ14	$C_{12}H_9N_3O$	243.21	215-216	61	Chloroform, DMSO, Ethanol, Methanol	Solid	0.67
BNZ15	$C_{17}H_{18}N_4O2$	310.35	211-213	66	Chloroform, DMSO, Ethanol, Methanol	Solid	0.90
BNZ16	$C_{15}H_{13}N_3O_5$	315.28	220-222	65.3	Chloroform, DMSO, Ethanol	Solid	0.79
BNZ17	$C_{13}H_8BrN_3O_3$	334.12	181-183	58	Chloroform, DMSO, Ethanol, Methanol	Solid	0.82
BNZ18	$C_{18}H_{10}F_3N_3O_3$	373.28	182-184	59	Chloroform, DMSO, Ethanol, Methanol	Solid	0.91
BNZ19	$C_{12}H_9N_3O_4$	259.21	179-180	65	Chloroform, DMSO, Ethanol, Methanol	Solid	0.71

Table 3: Spectral study of synthesized compounds

Name	IR spectra	1H-NMR spectra
BNZ 1	1710.98ν (C=O), 1690.08 ν (C=N), 1515.41 ν (C-C), 1411.45ν (C=C), 1058.96 ν (C-O-C), 754.78 ν (Ar C-H), 686.54 ν (C-S)	δ11.0 (s, 1H, COOH), 8.32-8.00 (m, 4H, Ar-H), 7.55 (t, 2H, Ar-H), 7.45 (d, 2H, Ar-H), 7.13 (d, 2H, Ar-H), 6.72 (d, 2H, Ar-H)
BNZ2	2303.91 ν (C≡N),1665.11 ν (C=N), 1585.15 ν (C-C), 1431.68 ν (C=C), 759.19 ν (Ar C-H), 645.11 ν (C-S)	δ 8.20-8.05 (d, 2H, Ar-H), 7.52 (t, 2H, Ar-H), 7.33-6.99 (m, 4H,Ar-H), 3.46 (m, 1H, CH), 1.57 (d, 3H, CH3)
BNZ3	1607.75 ν (C=N), 1515.50 ν (C-C), 1465.28 ν (C=C), 1050.58 ν (C-F), 745.14 ν (Ar C-H), 692.81 ν (C-S)	δ 8.25-8.12 (d, 2H, Ar-H), 7.56 (t, 2H, Ar-H), 7.46 (d, 1H, Ar-H), 7.34 (d, 1H, Ar-H), 7.02 (t, 1H, Ar-H)
BNZ4	3376.99 ν (OH), 1615.35 ν (C=N), 1549.28 ν (C-C), 1468.13 ν (C=C), 1318.19 ν (C-N), 1041.48 ν (C-O-C), 799.98 ν (Ar C-H), 672.07 ν (C-S)	δ 8.32-8.00 (d, 2H, Ar-H), 7.88 (s, 1H, Ar-H), 7.52 (t, 2H, Ar-H), 7.25 (s, 1H, Ar-H), 5.08 (s, 1H, OH), 3.99 (s, 3H, CH3)

BNZ5	1801.85 ν (C=O), 1650.31 ν (C=N), 1515.40 ν (C-C), 1435.28 ν (C=C), 756.63 ν (Ar C-H), 722.64 ν (C-Cl), 692.40 ν (C-S)	δ 8.03-8.00 (d, 2H, Ar-H), 7.85 (d, 1H, Ar-H), 7.70 (d, 2H, Ar-H), 7.59-7.32 (m, 7H, Ar-H)
BNZ6	1610.16 ν (C=N), 1544.62 ν (C-C), 1409.12 ν (C=C), 1199.10 ν (SO2Cl), 796.71 ν (Ar C-H), 679.41 ν (C-S)	δ 8.32-8.05 (m, 3H, Ar-H), 7.72 (d, 1H, Ar-H), 7.69 (d, 1H, Ar-H), 7.55 (m, 3H, Ar-H)
BNZ7	1605.61ν (C=N), 1506.82 ν (C-C), 1439.52 ν (C=C), 1204.16 ν (SO2Cl), 754.50 ν (Ar C-H), 670.11 ν (C-S)	δ 8.15 (d, 1H, Ar-H), 8.12 (d, 1H, Ar-H), 7.99 (d, 2H, Ar-H),7.72 (d, 2H, Ar-H), 7.54 (t, 2H, Ar-H)
BNZ8	3367.45 ν (OH), 1601.01 ν (C=N), 1508.41 ν (C-C), 1437.38 ν (C=C), 1039.98 ν (C-O-C), 750.17 ν (Ar C-H), 655 ν (C-S)	δ 8.59-8.05 (d, 2H, Ar-H), 7.49 (d, 2H, Ar-H), 6.97-6.68 (m, 3H,Ar-H), 4.65 (s, 1H, OH), 3.97 (m, 2H, CH2), 1.53 (t, 3H, CH3)
BNZ9	1728.86 ν (C=N), 1596.70 ν (C-C), 1439.12 ν (C=C), 1192.42 ν (C-F), 832.32 ν (Ar C-H), 722.53 ν (C-S)	δ 8.25 (d, 1H, Ar-H), 8.12 (d, 1H, Ar-H), 7.56 (t, 2H, Ar-H),7.21 (t, 1H, Ar-H), 7.04-6.73 (m, 3H, Ar-H)
BNZ10	1698.40 ν (C=N), 1515.09 ν (C-C), 1404.36 ν (C=C), 1077.57 ν (C-F), 789.28 ν (C-Cl), 742.04 ν (Ar C-H), 641.72 ν (C-S)	δ 8.32-8.00 (d, 2H, Ar-H), 7.71 (s, 1H, Ar-H), 7.55 (t, 2H, Ar-H), 7.40 (d, 1H, Ar-H), 6.72 (d, 1H, Ar-H)
BNZ11	1669.26 ν (C=N), 1586.48 ν (NO2), 1516.91 ν (C-C), 1417.09 ν (C=C), 752.05 ν (Ar C-H), 657.15 ν (C-S)	δ 8.28-8.04 (m, 4H, Ar-H), 7.73 (d, 2H, Ar-H), 7.51 (t, 2H, Ar-H)
BNZ12	1647.80 ν (C=N), 1523.76 ν (C-C), 1440.49 ν (C=C), 1022.14 (S=O), 802.37 ν (Ar C-H), 690.53 ν (C-S)	δ 8.31-8.09 (d, 2H, Ar-H), 7.97 (d, 2H, Ar-H), 7.68(d, 2H, Ar-H) 7.55 (t, 2H, Ar-H), 2.41 (s, 3H, CH3)
BNZ13	1710.98ν (C=O), 1690.08 ν (C=N), 1515.41 ν (C-C), 1411.45ν (C=C), 1058.96 ν (C-O-C), 754.78 ν (Ar C-H), 686.54 ν (C-S)	δ11.0 (s, 1H, COOH), 8.32-8.00 (m, 4H, Ar-H), 7.55 (t, 2H, Ar-H), 7.45 (d, 2H, Ar-H), 7.13 (d, 2H, Ar-H), 6.72 (d, 2H, Ar-H)
BNZ14	2303.91 ν (C≡N),1665.11 ν (C=N), 1585.15 ν (C-C), 1431.68 ν (C=C), 759.19 ν (Ar C-H), 645.11 ν (C-S)	δ 8.20-8.05 (d, 2H, Ar-H), 7.52 (t, 2H, Ar-H), 7.33-6.99 (m, 4H,Ar-H), 3.46 (m, 1H, CH), 1.57 (d, 3H, CH3)
BNZ15	1607.75 ν (C=N), 1515.50 ν (C-C), 1465.28 ν (C=C), 1050.58 ν (C-F), 745.14 ν (Ar C-H), 692.81 ν (C-S)	δ 8.25-8.12 (d, 2H, Ar-H), 7.56 (t, 2H, Ar-H), 7.46 (d, 1H, Ar-H), 7.34 (d, 1H, Ar-H), 7.02 (t, 1H, Ar-H)
BNZ16	1710.98ν (C=O), 1690.08 ν (C=N), 1515.41 ν (C-C), 1411.45ν (C=C), 1058.96 ν (C-O-C), 754.78 ν (Ar C-H), 686.54 ν (C-S)	δ11.0 (s, 1H, COOH), 8.32-8.00 (m, 4H, Ar-H), 7.55 (t, 2H, Ar-H), 7.45 (d, 2H, Ar-H), 7.13 (d, 2H, Ar-H), 6.72 (d, 2H, Ar-H)
BNZ17	1710.98ν (C=O), 1690.08 ν (C=N), 1515.41 ν (C-C), 1411.45ν (C=C), 1058.96 ν (C-O-C), 754.78 ν (Ar C-H), 686.54 ν (C-S)	δ11.0 (s, 1H, COOH), 8.32-8.00 (m, 4H, Ar-H), 7.55 (t, 2H, Ar-H), 7.45 (d, 2H, Ar-H), 7.13 (d, 2H, Ar-H), 6.72 (d, 2H, Ar-H)
BNZ18	2303.91 ν (C≡N),1665.11 ν (C=N), 1585.15 ν (C-C), 1431.68 ν (C=C), 759.19 ν (Ar C-H), 645.11 ν (C-S)	δ 8.20-8.05 (d, 2H, Ar-H), 7.52 (t, 2H, Ar-H), 7.33-6.99 (m, 4H,Ar-H), 3.46 (m, 1H, CH), 1.57 (d, 3H, CH3)
BNZ19	1607.75 ν (C=N), 1515.50 ν (C-C), 1465.28 ν (C=C), 1050.58 ν (C-F), 745.14 ν (Ar C-H), 692.81 ν (C-S)	δ 8.25-8.12 (d, 2H, Ar-H), 7.56 (t, 2H, Ar-H), 7.46 (d, 1H, Ar-H), 7.34 (d, 1H, Ar-H), 7.02 (t, 1H, Ar-H)

ANTIOXIDANT ACTIVITY:-

The anti-oxidant activity was assessed by DPPH method and ABTS method as described by Mensor *et al.10*

DPPH assay

The DPPH radical is one of the few stable organic nitrogen radicals, which bears a deep purple color. It is commercially available. Because of a strong absorption band centered at about 520 nm, the DPPH radical has a deep violet color in solution, and it becomes colorless or pale yellow when neutralized. This assay is based on the measurement of the reducing ability of anti-oxidants towards DPPH. The ability can be evaluated by electron spin resonance (EPR) or by measuring the decrease in its absorbance. Anti-oxidant assays are based on the loss of the DPPH color at 517 nm after reaction with the test compounds; the reaction is monitored by UV-Visible spectrophotometer.

Procedure:

0.01M solution of DPPH was prepared in methanol. Methanolic solutions of all the compounds in the

concentration ranges of 40µg/ml, 60µg/ml, 80µg/ml and 100µg/ml were prepared

Similarly, solutions of ascorbic acid in the same concentration ranges were prepared as standard. 1 ml of DPPH solution was added to 1 ml of the sample solution as well as ascorbic acid. The volume was finally made up to 3 ml using methanol. The test tubes containing the assay mixture were kept in a dark and cool place for 30 min. immediately after that the absorbance of the DPPH solution without sample, DPPH solution with sample and ascorbic acid with DPPH were recorded at 517 nm on a UV-Visible spectrophotometer. The antioxidant activity was measured using the formula.

% Scavenging or Inhibition = [(Ao-As)/Ao]*100

Where,

Ao= Absorbance of the DPPH solution without sample

As= Absorbance of DPPH solution with sample

ABTS assay

The assay is based on the ability of different compounds to scavenge 2, 2-azino-bis (ethylbenzthiazoline-6-sulfonic acid) radical cation. ABTS radicals have a characteristic absorbance at 734 nm. This absorbance decreases when the radical is reduced by any antiradical compound. The decrease in the absorbance can be measured using a UV-VIS spectrophotometer at 734 nm.

Procedure

7 mole ABTS stock solution in water was prepared. To it 2 mole solution of potassium persulfate was added in 1:1 ratio (volume/volume). This reaction mixture was left undisturbed in a dark place for about 16 h for generation of the radicals. This solution was further diluted using methanol so that it has a stable absorbance of 0.700±0.05 at 734 nm. Methanolic solutions of all compounds including ascorbic acid were prepared in the concentration ranges of 40µg/ml, 60µg/ml, 80µg/ml and 100µg/ml. Absorbance of the test sample, blank (methanol) and the standard solutions were taken immediately at 734 nm. The antioxidant activity of the samples was determined using the equation

% E = [(Ac-At)/Ac]* 100,
Where,
E= Anti-oxidant activity
Ac=Absorbance of the ABTS solution
At= Absorbance of the test compounds

RESULTS

Table 4: Percentage scavenging of DPPH radical by compounds and ascorbic acid

Name	Dilutions (µg/ml)			
	40µg/ml	60µg/ml	80µg/ml	100µg/ml
BNZ 1	48.02%	58.02%	69.02%	85.03%
BNZ2	49.02%	59.02%	71.33%	82.36%
BNZ3	53.02%	67.02%	78.25%	88.53%
BNZ4	38.02%	46.56%	59.02%	71.02%
BNZ5	46.32%	59.20%	67.05%	77.82%
BNZ6	36.06%	44.02%	55.02%	68.02%
BNZ7	43.02%	52.36%	63.74%	76.36%
BNZ8	44.02%	51.02%	66.02%	76.02%
BNZ9	48.03%	56.77%	68.02%	81.32%
BNZ10	51.02%	66.53%	76.33%	86.33%
BNZ11	44.03%	48.56%	58.03%	69.36%
BNZ12	25.02%	36.33%	48.02%	63.02%
BNZ13	33.18%	43.25%	53.03%	67.02%
BNZ14	26.02%	35.38%	46.33%	62.55%
BNZ15	43.35%	59.07%	62.33%	71.04%
BNZ16	41.04%	58.06%	64.36%	69.03%
BNZ17	44.53%	54.05%	61.02%	71.55%
BNZ 18	39.41%	52.45%	65.01%	74.03%
BNZ19	33.32%	39.36%	42.02%	56.55%
Ascorbic acid	**64.49%**	**71.33%**	**86.010%**	**92.34%**

Table 5: Percentage scavenging of ABTS radical by compounds and ascorbic acid

Name	Dilutions (µg/ml)			
	40µg/ml	60µg/ml	80µg/ml	100µg/ml
BNZ 1	38.45%	56.23%	67.23%	79.02%
BNZ2	40.21%	58.32%	64.58%	78.52%
BNZ3	36.75%	45.02%	56.02%	75.32%
BNZ4	38.35%	48.56%	58.23%	70.32%
BNZ5	10.33%	11.02%	19.23%	29.56%
BNZ6	35.23%	43.23%	51.23%	63.01%
BNZ7	33.22v	42.02%	52.12%	61.23%
BNZ8	16.21%	15.02%	18.23%	26.23%
BNZ9	26.32%	34.23%	42.03%	58.23%
BNZ10	33.21%	44.25%	58.36%	64.36%
BNZ11	34.21%	43.45%	53.65%	64.35%
BNZ12	29.63%	38.56%	51.36%	61.35%
BNZ13	24.23%	33.23%	48.23%	63.45%
BNZ14	19.33%	26.12%	47.23%	58.23%
BNZ15	31.22%	46.23%	55.32%	69.32%
BNZ16	33.02%	44.12%	63.45%	79.54%
BNZ17	36.57%	53.12%	67.21%	79.03%
BNZ 18	22.33%	32.31%	49.56%	68.33%
BNZ19	18.33%	26.33%	39.32%	51.32%
Ascorbic acid	**511.02%**	**58.63%**	**71.40%**	**90.01%**

DISCUSSION

Gale CR. et al. (2016) on his studies on benzimidazole showed that better antioxidant activity is due to the electronegative substituent at position-5(methoxy), position-4(nitro), position-2(2-methoxy-4-hydroxy). **Likhar Rupali et al. (2016) in her studies showed that** the compounds which showed good antioxidant activity contain electronegative group at position-3(amino), position-4(chloro) and position-2(hydroxyl group with bigger ring). **Buettner GR. et al. (2017)** in his research on benzimidazole showed that comparable good antioxidant activity is due to the electronegative substituent at position-1($-OCH_3$), position-4($-NH_2$), position-2($-C_6H_4CHF_2$). **Pawar PY et al. (2017)** has published that the compounds which showed good antioxidant activity contains electronegative group at position-5 and 6(Cl), position-4($-CH_3$) and position-2(isoquinoline ring). **Kashif MK, et al. (2018)** in his studies on benzimidazole showed that better antioxidant activity is due to the electron withdrawing substituent at position-3($-C_2H_5$), position-4($-NO_2$), position-2(quinoline ring).

To assess the free radical scavenging activity of synthesized benzimidazole compounds, DPPH and ABTS assays were conducted, and the results are indicated in table 4 and 5 respectively. From the results, it is clear that the efficacy of BNZ-1, BNZ-2, BNZ-3, BNZ-9, and BNZ-10 as antioxidant agents was better in DPPH assay and compound BNZ-1, BNZ-2, BNZ-3, BNZ-16, and BNZ-17 in ABTS assay.

The pharmacophore of compound BNZ-1 have fluoro group and compound BNZ-2 and BNZ-3 have amino group, compound BNZ-9 have nitro group with hydroxyl group, compound BNZ-10 have keto group with amino group, Compound BNZ-16 have methoxy group and compound BNZ-17 have halide group which infers that all attached groups are electronegative and in concurrence with previous studies, our research also says that presence of electro negativity is the major contributing factor towards antioxidant activity.

CONCLUSION:-

In this research, 19 new benzimidazole derivatives were synthesized using well recognized synthetic protocols. The synthesized compounds were characterized using ATIR and 1HNMR techniques and were screened for their antioxidant potential.

Results suggest that compounds BNZ-1, BNZ-3, BNZ-3, BNZ-9 and BNZ-10 are the efficient scavengers of DPPH and BNZ-1, BNZ-2, BNZ-3, BNZ-16, BNZ-17 are the efficient scavengers of ABTS radicals. From the structure-activity perspective, the position of the electron donating functional groups on the benzimidazole core may promote the expected antioxidant activity. Further derivatization of these substances will result in more selective antioxidant agents.

REFERENCES:-

1. Ozkay, Y., Tunai, Y., Karaca, H. and Isikdag, I. Antimicrobial activity and a SAR study of some novel benzimidazole derivatives bearing hydrazone moiety. Eur. J. Med. Chem. 2010; 45:3293-3298.
2. Nofal Z.M., Soliman E.A., Abd E-K. S.S., Elzahar M. I.,Srour A.M., Shetumadhavan S. andTimothy J.M.Novel benzimidazole derivatives as expected anticancer agents.Acta Poloniae Pharmaceutica-Drug Res. 2011; 68:519-534.

3. Achar, K.C., Hosamani, K.M. and Seetaramareddy, H.R. In-vivo analgesic and anti-inflammatory activities of newly synthesized benzimidazolederivatives. Eur. J. Med. Chem. 2010; 45: 2048-54.
4. Lu, Y., Liu, Y., Xu, Z., Li, H., Liu, H. and Zhu, W. Halogen bonding for rational drug design and new drug discovery. Expert Opinion on Drug Discovery. 2012; 7:375-383.
5. Al-Masoudi, N.A. and Abbas, Z.A.A. Synthesis and biological activity of new metronidazole derivatives. Monatsh Chem. 2016; 147:383-390.
6. Archie, S.R., Das B.K., Hossain, M.S., Kumar, U. and Rouf, A.S.S. Synthesis and antioxidant activity of 2- substituted-5-nitro benzimidazole derivatives. International J. Pharmacy and Pharmaceutical Sci. 2017; 9:308-310.
7. Mavrova AT, Wesselinova D, Tsenov JA, Denkova P. Cytotoxic Effects of some N-Substituted-2-Amino-1H-Benzimidazoles. J Bioequiv Availab 2012; 4: 52–55.
8. Maske PP, Lokapure SG, Nimbalkar D, Disouza JI. Synthesis and antiprotozoal activity of nitro and halogeno substituted novel mercapto benzimidazole derivatives. Der Pharm Chem. 2012; 4:1283-7.
9. Y. Chew, Y. Lim, Evaluation and Comparison of Antioxidant Activity of Leaves, Pericarps and Pulps of Three Garcinia Species in Malaysia, Free Radicals and Antioxidants. 2018; 8:130-134.
10. B. Onyeachua, I. B. Obot, A. A. Sorour, M. I. Abdul-Rashid, Green corrosion inhibitor for oilfield application I: Electrochemical assessment of 2-(2-pyridyl) benzimidazole for API X60 Steel under sweet environment in NACE brine ID196, Corrosion Science, 2019;150:183-193.
11. N. Srestha, J. Banerjee, S. Srivastava,. A review on chemistry and biological significance of benzimidazole nucleus, IOSR Journal of Pharmacy. 2014; 12:28-41.
12. S. Gurvinder, K. Maninderjit, C. Mohan, Benzimidazoles: The latest information on biological activities, IRJP. 2013;4:82-87