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Der Chemica Sinica, 2016, 7(3): 9-15

Pelagia Research Library
ISSN: 0976-8505
CODEN (USA) CSHIA5

Synthesis of benzofurans and cinnamoylbenzofurans and their antimicrobial evaluation

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ABSTRACT

Benzofurans and cinnamoylbenzofurans were synthesized starting from resacetophenone under microwave irradiation method and evaluated for their antimicrobial activity. The structures of all synthesized compounds were elucidated based on their spectral studies.

Keywords: Benzofurans, cinnamoylbenzofurans, microwave irradiation, antimicrobial activity

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INTRODUCTION

Benzofurans, often found in naturally occurring or synthetic compounds, are attractive to chemists for their various biological activities such as antibacterial [1], antifungal [2], anti-inflammatory [3], analgesic [4], antidepressant [5], antitumor [6], anti-HIV [7], antidiabetic [8], antitubercular [9] and antioxidant [10] activities. On the other hand, chalcones are aromatic compounds with an unsaturated side chain and present abundantly in nature from ferns to higher plants [11]. Chalcones were found to possess anti-inflammatory, analgesic and antipyretic activities [12] and also act as anti-malarial [13] and antifungal agents [14]. Chalcones having benzofuran moiety were also exhibiting good antimicrobial activity [15]. In continuous of our interest on the synthesis of potent antimicrobial agents, herein we report the rapid synthesis of Benzofurans and cinnamoylbenzofurans by using microwave irradiation method and evaluated for their antimicrobial activity.

MATERIALS AND METHODS

Melting points were determined in open capillaries using Stuart SMP30 melting point apparatus and are uncorrected. Microwave irradiation was carried out on a BPL, 800 model microwave oven. The progress of the reaction was monitored by TLC and visualized with UV light and iodine vapors. IR spectra were recorded on Perkin-Elmer 100S spectrophotometer using KBr disk. ^{1}H NMR spectra were recorded on Bruker-400 MHz spectrometer using TMS as an internal standard. The C, H and N analysis of the compounds were recorded on a Carlo Erba modal EA1108 and mass spectra were recorded on a Jeol JMSD-300 spectrometer.

General procedure for the synthesis of 4-Acetonyloxy-2-hydroxyacetophenone (3)
A mixture of 2,4-dihydroxyacetophenone (1 mmol), chloroacetone (1 mmol) were doped with baked potassium carbonate (2 gm) with few drops of acetone and the solid mixture was irradiated in microwave for 50 sec at 300 watt

power level. After completion of the reaction shown by TLC, the inorganic impurities were filtered and poured in to cold water. The solid obtained was filtered, washed with water, dried and recrystallised from ethanol.

General procedure for the synthesis of 5-acetyl-6-hydroxy-3-methylbenzofuran (4)
A mixture of 4-Acetonyloxy-2-hydroxyacetophenone (2 gm), baked potassium carbonate (2 gm) doped with 0.5 mL of acetone and the solid mixture was irradiated in microwave for 1 min at 300 watt power level. The completion of the reaction was monitored with TLC and inorganic substances were removed by pouring in to water and the resulting solid was recrystallised from hot ethanol.

General procedure for the synthesis of 5-acetyl-6-β-*t*-alkylaminoalkoxy-3-methylbenzofuran derivatives (6a-d)
A mixture of 5-acetyl-6-hydroxy-3-methylbenzofuran (2 mmol) and β-t-alkylaminoalkyl chloride hydro chloride (2 mmol) in acetone (1.0 mL) was irradiated in microwave oven at 450 watt power level for 1-3 min. Progress of the reaction was monitored by TLC, poured the contents in to ice cold water. The solid thus separated out was filtered, dried and recrystallised from ethanol.

General procedure for the synthesis of 5-cinnamoyl-6-β-*t*-alkylaminoalkoxy-3-methylbenzofuran derivatives (8a-p)
5-acetyl-6-β-*t*-alkylaminoalkoxy-3-methylbenzofuran derivatives (2 mmol) taken in a pyrex beaker, to this various benzaldehydes (2 mmol) and 2 mL of 10% NaOH was added, covered with a watch glass. The beaker was kept in a petridish containing ice cold water. The contents were irradiated in domestic microwave oven at power level 150 W for 2-4 min. The mixture was quenched with cold water and acidified with 1:1 HCl to yield a solid product. The crude product was filtered dried and recrystallised from benzene.

Characterization data
1-(6-(2-(pyrrolidin-1-yl)ethoxy)-3-methylbenzofuran-5-yl)-3-phenylprop-2-en-1-one (8a): Yellow solid; mp. 91-93 ºC; IR (KBr, cm^{-1}) υ_{max}: 2920, 1641, 1613, 1576, 1215, 865; ^{1}H NMR (400 MHz, $CDCl_3$): δ 1.72 (m, 4H), 2.28 (s, 3H), 2.33 (m, 4H), 2.73 (t, 2H, *J* = 10.4 Hz), 4.21 (t, 2H, *J* = 11.2 Hz), 7.06 (s, 1H), 7.10-7.61 (m, 7H), 8.14 (s, 1H), 8.21 (s, 1H); MS (ESI) *m/z*: 375 (M^+); Anal. Calcd. for $C_{24}H_{25}NO_3$; C, 76.77; H, 6.71; N, 3.73. Found: C, 76.84; H, 6.63; N, 3.85.

1-(6-(2-(pyrrolidin-1-yl)ethoxy)-3-methylbenzofuran-5-yl)-3-(4-chlorophenyl)prop-2-en-1-one (8b): Yellow solid; mp. 113-115 ºC; IR (KBr, cm^{-1}) υ_{max}: 2922, 1644, 1608, 1579, 1217, 862, 710; ^{1}H NMR (400 MHz, $CDCl_3$): δ 1.70 (m, 4H), 2.25 (s, 3H), 2.30 (m, 4H), 2.72 (t, 2H, *J* = 9.6 Hz), 4.19 (t, 2H, *J* = 12.4 Hz), 7.05 (s, 1H), 7.08-7.79 (m, 6H), 8.13 (s, 1H), 8.19 (s, 1H); MS (ESI) *m/z*: 409 (M^+); Anal. Calcd. for $C_{24}H_{24}ClNO_3$; C, 70.32; H, 5.90; N, 3.42. Found: C, 70.45; H, 6.81; N, 3.51.

1-(6-(2-(pyrrolidin-1-yl)ethoxy)-3-methylbenzofuran-5-yl)-3-(3-nitrophenyl)prop-2-en-1-one (8c): Yellow solid; mp. 148-150 ºC; IR (KBr, cm^{-1}) υ_{max}: 2925, 1648, 1617, 1588, 1227, 862, 709; ^{1}H NMR (400 MHz, $CDCl_3$): δ 1.66 (m, 4H), 2.25 (s, 3H), 2.44 (m, 4H), 2.77 (t, 2H, *J* = 10.8 Hz), 4.19 (t, 2H, *J* = 10.4 Hz), 6.93 (d, 1H, *J* = 7.8 Hz), 7.16 (s, 1H), 7.41 (s, 1H), 7.58 (d, 4H, *J* = 8 Hz), 7.83 (s, 1H), 8.16 (d, 1H); MS (ESI) *m/z*: 420 (M^+); Anal. Calcd. for $C_{24}H_{24}N_2O_5$; C, 68.56; H, 5.75; N, 6.66. Found: C, 68.87; H, 5.66; N, 6.72.

1-(6-(2-(pyrrolidin-1-yl)ethoxy)-3-methylbenzofuran-5-yl)-3-(4-methoxyphenyl)prop-2-en-1-one (8d): Yellow solid; mp. 135-137 ºC; IR (KBr, cm^{-1}) υ_{max}: 2924, 1641, 1625, 1583, 1225, 855, 776; ^{1}H NMR (400 MHz, $CDCl_3$): δ 1.63 (m, 4H), 2.23 (s, 3H), 2.40 (m, 4H), 2.76 (t, 2H), 3.85 (t, 3H, *J* = 10.4 Hz), 4.19 (t, 2H, *J* = 10.8 Hz), 6.87 (d, 1H), 7.12 (s, 1H), 7.34 (s, 1H), 7.55 (d, 4H, *J* = 7.4 Hz), 7.79 (s, 1H), 8.15 (d, 1H, *J* = 7.0 Hz); MS (ESI) *m/z*: 405 (M^+); Anal. Calcd. for $C_{25}H_{27}NO_4$; C, 74.05; H, 6.71; N, 3.45. Found: C, 74.27; H, 6.67; N, 3.49.

1-(6-(2-(piperidin-1-yl)ethoxy)-3-methylbenzofuran-5-yl)-3-phenylprop-2-en-1-one (8e): Yellow solid; mp. 99-93 ºC; IR (KBr, cm^{-1}) υ_{max}: 2910, 1640, 1610, 1580, 1210, 860, 710; ^{1}H NMR (400 MHz, $CDCl_3$): δ 1.73 (m, 6H), 2.25 (s, 3H), 2.31 (m, 4H), 2.75 (t, 2H, *J* = 9.6 Hz Hz), 4.19 (t, 2H, *J* = 10.0 Hz), 7.01 (s, 1H), 7.06-7.56 (m, 7H), 8.13 (s, 1H), 8.19 (s, 1H); MS (ESI) *m/z*: 389 (M^+); Anal. Calcd. for $C_{25}H_{27}NO_3$; C, 77.09; H, 6.99; N, 3.60. Found: C, 77.17; H, 6.87; N, 3.65.

1-(6-(2-(piperidin-1-yl)ethoxy)-3-methylbenzofuran-5-yl)-3-(4-chlorophenyl)prop-2-en-1-one (8f): Yellow solid; mp. 148-150 ºC; IR (KBr, cm^{-1}) υ_{max}: 2920, 1643, 1613, 1589, 1225, 865, 743; ^{1}H NMR (400 MHz, $CDCl_3$): δ 1.81 (m, 6H), 2.34 (s, 3H), 2.38 (m, 4H), 2.81 (t, 2H, *J* = 9.2 Hz), 4.17 (t, 2H, *J* = 9.6 Hz), 7.05 (s, 1H), 7.13-7.63 (m, 6H), 8.21 (s, 1H), 8.26 (s, 1H); MS (ESI) *m/z*: 423 (M^+); Anal. Calcd. for $C_{25}H_{26}ClNO_3$; C, 70.83; H, 6.18; N, 3.30. Found: C, 70.53; H, 6.09; N, 3.39.

1-(6-(2-(piperidin-1-yl)ethoxy)-3-methylbenzofuran-5-yl)-3-(3-nitrophenyl)prop-2-en-1-one (8g): Yellow solid; mp. 165-1167 ºC; IR (KBr, cm^{-1}) υ_{max}: 2922, 1645, 1615, 1578, 1225, 860, 710; ^{1}H NMR (400 MHz, $CDCl_3$): δ 1.65 (m, 6H), 2.23 (s, 3H), 2.40 (m, 4H), 2.74 (t, 2H, *J* = 9.2 Hz), 4.15 (t, 2H, *J* = 8.8 Hz), 6.88 (d, 1H, *J* = 7.0 Hz), 7.12 (s, 1H), 7.36 (s, 1H), 7.53 (d, 4H, *J* = 7.2 Hz), 7.78 (s, 1H), 8.15 (d, 1H, *J* = 7.2 Hz); MS (ESI) *m/z*: 434 (M^+); Anal. Calcd. for $C_{25}H_{26}N_2O_5$; C, 69.11; H, 6.03; N, 6.45. Found: C, 69.47; H, 5.89; N, 6.50.

1-(6-(2-(piperidin-1-yl)ethoxy)-3-methylbenzofuran-5-yl)-3-(4-methoxyphenyl)prop-2-en-1-one (8h): Yellow solid; mp. 98-100 ºC; IR (KBr, cm^{-1}) υ_{max}: 2924, 1640, 1620, 1580, 1220, 850, 770; ^{1}H NMR (400 MHz, $CDCl_3$): δ 1.64 (m, 6H), 2.21 (s, 3H), 2.38 (m, 4H), 2.75 (t, 2H, *J* = 8.8 Hz), 3.83 (t, 3H, *J* = 8.4 Hz), 4.17 (t, 2H, *J* = 8.0 Hz), 6.85(d, 1H, *J* = 7.2 Hz), 7.02 (s, 1H), 7.31 (s, 1H), 7.51 (d, 4H, *J* = 7.6 Hz), 7.75 (s, 1H), 8.1 (d, 1H, 7.2 Hz); MS (ESI) *m/z*: 419 (M^+); Anal. Calcd. for $C_{26}H_{29}NO_4$; C, 74.44; H, 6.97; N, 3.34. Found: C, 74.37; H, 7.07; N, 3.39.

1-(6-(2-morpholinoethoxy)-3-methylbenzofuran-5-yl)-3-phenylprop-2-en-1-one (8i): Yellow solid; mp. 98-100 ºC; IR (KBr, cm^{-1}) υ_{max}: 2970, 1650, 1620, 1580, 1220, 850, 760, 730; ^{1}H NMR (400 MHz, $CDCl_3$): δ 2.19 (s, 3H), 2.56 (t, 4H, *J* = 7.6 Hz), 2.75 (t, 2H, *J* = 8.4 Hz), 3.56 (m, 4H), 4.19 (t, 2H, *J* = 8.4 Hz), 7.03 (s, 1H), 7.19-7.54 (m, 7H), 8.06 (s, 1H), 8.13 (s, 1H); MS (ESI) *m/z*: 391 (M^+); Anal. Calcd. for $C_{24}H_{25}NO_4$; C, 73.64; H, 6.44; N, 3.58. Found: C, 73.79; H, 6.21; N, 3.64.

1-(6-(2-morpholinoethoxy)-3-methylbenzofuran-5-yl)-3-(4-chlorophenyl)prop-2-en-1-one (8j): Yellow solid; mp. 144-146 ºC; IR (KBr, cm^{-1}) υ_{max}: 2974, 1655, 1618, 1578, 1225, 856, 764, 726; ^{1}H NMR (400 MHz, $CDCl_3$): δ 2.20 (s, 3H), 2.54 (t, 4H, *J* = 8.8 Hz), 2.79 (t, 2H, *J* = 8.4 Hz), 3.61 (m, 4H), 4.23 (t, 2H, *J* = 9.2 Hz), 7.10 (s, 1H), 7.21-7.56 (m, 6H), 8.09 (s, 1H), 8.16 (s, 1H); MS (ESI) *m/z*: 425 (M^+); Anal. Calcd. for $C_{24}H_{24}ClNO_4$; C, 67.68; H, 5.68; N, 3.29. Found: C, 68.92; H, 5.59; N, 3.48.

1-(6-(2-morpholinoethoxy)-3-methylbenzofuran-5-yl)-3-(3-nitrophenyl)prop-2-en-1-one (8k): Yellow solid; mp. 165-167 ºC; IR (KBr, cm^{-1}) υ_{max}: 2971, 1653, 1624, 1589, 1224, 860, 750, 722; ^{1}H NMR (400 MHz, $CDCl_3$): δ 2.21 (s, 3H), 2.52 (t, 4H, *J* = 10.4 Hz), 2.77 (t, 2H, *J* = 8.8 Hz), 3.59 (m, 4H), 4.27 (t, 2H, J = 8.4 Hz), 7.16 (s, 1H), 7.25-7.60 (m, 6H), 8.12 (s, 1H), 8.17 (s, 1H); MS (ESI) *m/z*: 436 (M^+); Anal. Calcd. for $C_{24}H_{24}N_2O_6$; C, 66.04; H, 5.54; N, 6.42. Found: C, 66.42; H, 5.19; N, 6.51.

1-(6-(2-morpholinoethoxy)-3-methylbenzofuran-5-yl)-3-(4-methoxyphenyl)prop-2-en-1-one (8l): Yellow solid; mp. 100-102 ºC; IR (KBr, cm^{-1}) υ_{max}: 2976, 1656, 1616, 1577, 1223, 865, 772, 718; ^{1}H NMR (400 MHz, $CDCl_3$): δ 2.14 (m, 6H), 2.26 (s, 3H), 2.37 (m, 4H), 2.76 (t, 2H, *J* = 10.4 Hz), 3.82 (t, 3H, *J* = 8.8 Hz), 4.18 (t, 2H, *J* = 8.4 Hz), 6.85 (d, 1H, *J* = 7.2 Hz), 7.04 (s, 1H), 7.53 (d, 4H, *J* = 7.6 Hz), 7.32 (s, 1H), 7.75 (s, 1H), 8.1 (d, 1H, *J* = 6.8 Hz); MS (ESI) *m/z*: 421 (M^+); Anal. Calcd. for $C_{25}H_{27}NO_5$; C, 71.24; H, 6.46; N, 3.32. Found: C, 70.89; H, 6.27; N, 3.38.

1-(6-(2-diethylamino)ethoxy)-3-methylbenzofuran-5-yl)-3phenylprop-2-en-1-one (8m): Yellow solid; mp. 60-62 ºC; IR (KBr, cm^{-1}) υ_{max}: 2940, 1640, 1610, 1570, 1220, 840,780; ^{1}H NMR (400 MHz, $CDCl_3$): δ 1.01 (m, 6H), 2.19 (s, 3H), 2.68 (m, 4H), 2.81 (t, 2H, *J* = 8.8 Hz), 4.12 (t, 2H, *J* = 8.4 Hz), 7.02 (s, 1H), 7.19-7.53 (m, 7H), 8.13 (s, 1H), 8.17 (s, 1H); MS (ESI) *m/z*: 377 (M^+); Anal. Calcd. for $C_{24}H_{27}NO_3$; C, 76.36; H, 7.21; N, 3.71. Found: C, 76.23; H, 7.08; N, 3.82.

1-(6-(2-diethylamino)ethoxy)-3-methylbenzofuran-5-yl)-3-(4-chlorophenyl)prop-2-en-1-one (8n): Yellow solid; mp. 82-84 ºC; IR (KBr, cm^{-1}) υ_{max}: 2930, 1642, 1613, 1580, 1224, 875, 794,748; ^{1}H NMR (400 MHz, $CDCl_3$): δ 1.03 (m, 6H), 2.16 (s, 3H), 2.66 (m, 4H), 2.78 (t, 2H, *J* = 9.6 Hz), 4.03 (t, 2H, *J* = 9.6 Hz), 6.99 (s, 1H), 7.16-7.50 (m, 6H), 8.12 (s, 1H), 8.15 (s, 1H); MS (ESI) *m/z*: 411 (M^+); Anal. Calcd. for $C_{24}H_{26}ClNO_3$; C, 69.98; H, 6.36; N, 3.40. Found: C, 70.26; H, 6.19; N, 3.48.

1-(6-(2-diethylamino)ethoxy)-3-methylbenzofuran-5-yl)-3-(3-nirophenyl)prop-2-en-1-one (8o): Yellow solid; mp. 147-149 ºC; IR (KBr, cm^{-1}) υ_{max}: 2932, 1641, 1608, 1570, 1222, 850, 770; ^{1}H NMR (400 MHz, $CDCl_3$): δ 1.005

(m, 6H), 2.20 (s, 3H), 2.69 (m, 4H), 2.89 (t, 2H, *J* = 10.0 Hz), 4.13 (t, 2H, *J* = 8.8 Hz), 7.06 (s, 1H), 7.20-7.56 (m, 6H), 8.14 (s, 1H), 8.17 (s, 1H); MS (ESI) *m/z*: 422 (M^+); Anal. Calcd. for $C_{24}H_{26}N_2O_5$; C, 68.23; H, 6.20; N, 6.63. Found: C, 68.56; H, 6.13; N, 6.67.

1-(6-(2-diethylamino)ethoxy)-3-methylbenzofuran-5-yl)-3-(4-methoxyphenyl)prop-2-en-1-one (8p): Yellow solid; mp. 124-126 ºC;IR (KBr, cm^{-1}) υ_{max}: 2928, 1635, 1616, 1572, 1225, 853; ^{1}H NMR (400 MHz, $CDCl_3$): δ 1.005 (m, 6H), 2.21 (s, 3H), 2.26 (s, 3H), 2.71 (m, 4H), 2.91 (t, 2H, *J* = 10.4 Hz), 4.14 (t, 2H, *J* = 9.6 Hz), 7.04 (s, 1H), 7.26-7.58 (m, 6H), 8.13 (s, 1H), 8.16 (s,1H); MS (ESI) *m/z*: 407 (M^+); Anal. Calcd. for $C_{25}H_{29}NO_4$; C, 73.68; H, 7.17; N, 3.44. Found: C, 74.12; H, 7.02; N, 3.61.

RESULTS AND DISCUSSION

The synthetic path way of the title compounds, benzofurans **(6a-d)** and cinnamoylbenzofurans **(8a-p)** has displayed in **Scheme 1.** Initially the reaction between resacetophenone (**1**) and chloroacetone (**2**) was carried out in 1:1 and 1:2 molar ratios. Two different compounds, 1-(4-acetyl-3-hydroxy-phenoxy)propan-2-one (**3a**) and 1-[4-acetyl-3-(2-oxo-propoxy)-phenoxy]propan-2-one (**3b**) were obtained in 82 and 80 % of yields respectively. Both the compounds were differentiated by ferric chloride test, compound (**3a**) has exhibited green color indicated the presence of phenolic OH group, while compound (**3b**) has shown a negative test indicated the absence of phenolic OH group. We also observed different R_f values for **3a** and **3b** in TLC with hexane:ethyl acetate (9:1 mL) as eluent. Hence, we carried out the reaction in 1:1 molar ratio under microwave irradiation conditions and obtained the desired product (**3a**) in good yield. 1-(4-Acetyl-3-hydroxy-phenoxy)propan-2-one (**3a)** furnished 5-acetyl-6-hydroxy-3-methylbenzofuran (**4**) in 86% of yield when doped with baked potassium carbonate and few drops of acetone under microwave irradiation condition. The compound **4** is treated with β-*t*-alkylaminoalkylchloride hydrochlorides (**5a-d**) under similar conditions afforded **6a-d**. Subsequently, **6a-d** is irradiated with various aromatic aldehydes (**7a-d**) under microwave irradiation furnished (**8a-p)** in good yields (**Table-1**). Structures of all the synthesized compounds were elucidated based on the spectral studies (IR, ^{1}H NMR and Mass).

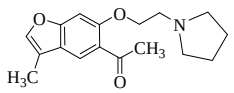
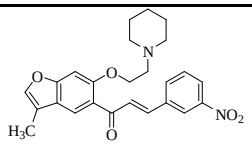
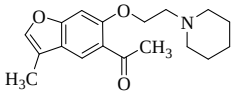
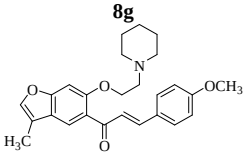
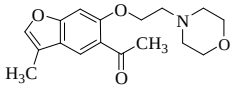
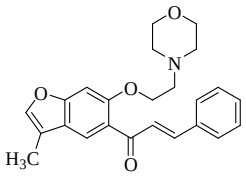
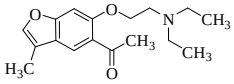
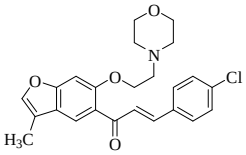
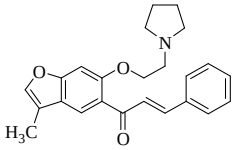
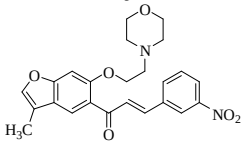
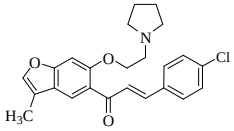
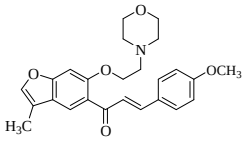
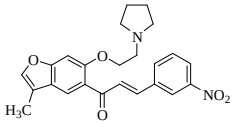
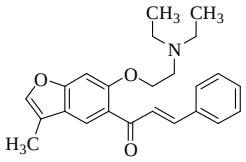
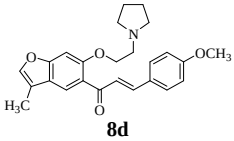
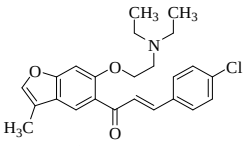
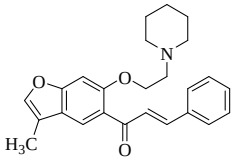
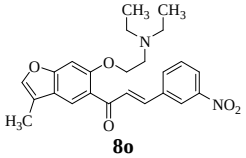
Antimicrobial activity

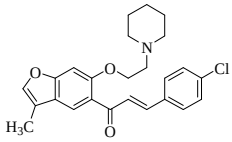
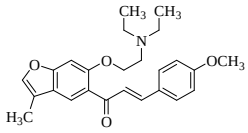
All the newly synthesized compounds (6a-d & 8a-p) were evaluated for their in vitro antibacterial activity against Gram-positive bacteria (*Staphylococcus aureus* and *Bacillus subtilis*), Gram-negative bacteria (*Proteus vulgaris* and *Klebsiella pneumoniae*) and anti fungal activity against *Candida albicans*. The values are compared with those of standard antibiotic drug Kanamycin for bacteria and Clotrimazole for fungus.

Zone of inhibition (in mm) values for analogs (6a-d & 8a-p) and positive control drugs kanamycin, Clotrimazole were determined against four different bacterial strains and one fungal strain by agar disc-diffusion method [16,17]. The microbial strains were grown and maintained on nutrient agar plates. All the compounds were dissolved in DMSO (100 µg/mL and transferred to each disc with the help of a micropipette simultaneously maintained a standard drug Kanamycin and Clotrimazole (30 µg/mL). After overnight incubation at 37 °C, the resulting ZOIs were measured and compared with the standard drug. All the experiments were performed in triplicates and the average zones of inhibition was recorded and depicted in **Table-2**.

From the zone of inhibition values, we noticed that all the 5-cinnamoyl-6-β-t-alkylaminoalkoxy-3-methylbenzofuran derivatives (8a-p) are exhibited good antimicrobial activity than 5-acetyl-6-β-t-alkylaminoalkoxy-3-methylbenzofuran derivatives (6a-d). Hence it is confirmed that the presence of cinnamoyl group enhances the antimicrobial activity of compounds. Especially the compounds having β-morpholinoethoxy group (**8i, 8j, 8k & 8l**) were possess excellent anti bacterial activity in the range of zone of inhibition 18-28 mm as well as anti fungal activity in the range of 19-25mm of zone of inhibition compared to standard drugs. In over all vision of antimicrobial activity data, compounds **8i** & **8l** having highest antimicrobial activity than other compounds.

Table-1. Synthesis of 5-acetyl-6-β-*t*-alkylaminoalkoxy-3-methylbenzofurans and 5-cinnamoyl-6-β-*t*-alkylaminoalkoxy-3-methylbenzofuran derivatives under microwave irradiation.

Entry[a]	Compound	Time (min)	Yield[b] (%)	Entry[a]	Compound	Time (min)	Yield[b] (%)
1	 **6a**	1	85	11	 **8g**	2	88
2	 **6b**	3	78	12	 **8h**	2	83
3	 **6c**	2	83	13	 **8i**	3	73
4	 **6d**	3	82	14	 **8j**	2	85
5	 **8a**	3	80	15	 **8k**	2	84
6	 **8b**	2	81	16	 **8l**	3	82
7	 **8c**	4	86	17	 **8m**	4	77
8	 **8d**	2	80	18	 **8n**	2	82
9	 **8e**	3	76	19	 **8o**	3	88

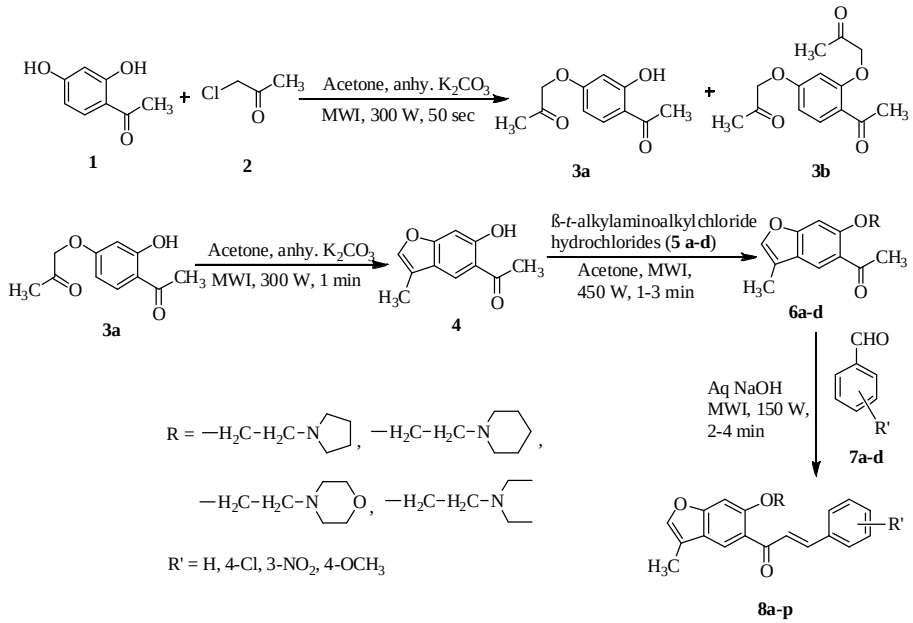
10	 **8f**	3	83	20	 **8p**	4	86

[a]*Reaction conditions: For 6a-d: 5-Acetyl-6-hydroxy-3-methylbenzofuran (2 mmol), β-t-alkylaminoalkylchloride hydrochloride (2 mmol), Acetone (1 mL), MWI, 450 W; For 8a-p: 5-Acetyl-6-β-t-alkylaminoalkoxy-3-methylbenzofuran derivatives (2 mmol), Substituted benzaldehydes (2 mmol) and 10% aq NaOH (2 mL), MWI, 150 W.*
[b]*Isolated yields.*

Table-2. Antimicrobial activity

Zone of Inhibition					
	Gram-positive bacteria		Gram-negative bacteria		Fungi
Analog	*S. aureus*	*B. subtillis*	*P.vulgaris*	*K.pneumoniae*	*C. albicans*
6a	8	9	12	11	14
6b	7	13	10	10	9
6c	11	16	14	18	13
6d	9	12	10	8	11
8a	15	18	17	14	16
8b	13	12	14	11	13
8c	12	12	15	14	14
8d	16	18	18	16	18
8e	14	16	15	20	15
8f	17	18	14	20	19
8g	18	14	16	18	20
8h	20	16	18	17	19
8i	23	25	28	23	26
8j	24	27	23	20	22
8k	19	21	18	21	19
8l	26	24	27	26	28
8m	18	18	16	16	15
8n	16	19	17	17	18
8o	17	15	19	18	17
8p	20	22	24	21	16
Kanamycin	31	33	29	32	-
Clotrimazole	-	-	-	-	29

' - 'Refers inactive.



Scheme-1. Synthesis of benzofurans and cinnamoylbenzofurans

CONCLUSION

In conclusion, we have synthesized a series of benzofurans and cinnamoylbenzofuran derivatives under microwave irradiation method and assessed for their antimicrobial activity.

Acknowledgements
We would like to thank Dr Nagarjun Department of Microbiology, Osmania University, Hyderabad for screening antimicrobial activity. One of the author D R thanks to CSIR, New Delhi for providing research fellowship.

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