

Novel microwave-assisted synthesis of the organotellurium compound ammonium trichloro (dioxoethylene-O,O') tellurate (AS101)

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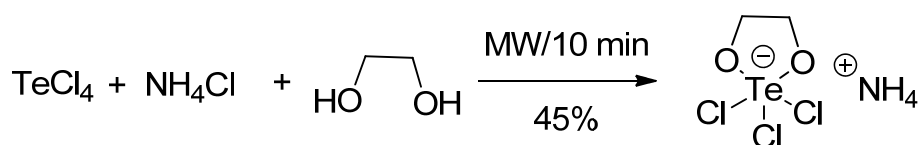
Abstract:

Ammonium trichloro[1,2-ethanediolato-O,O']-tellurate (AS101) is a potent immunomodulator with a variety of potential therapeutic applications. An easy, efficient and fast procedure for syntheses of AS101 by microwave-assisted organic synthesis is presented.

Keywords: tellurium, AS101, immunomodulator, microwave

Over recent years, heating and driving chemical reactions by microwave (MW) energy has been a significant interest in the scientific community, in particular applied to microwave-assisted organic synthesis (MAOS) and drug discovery [1]. Ammonium trichloro[1,2-ethanediolato-O,O']-tellurate (AS101) is the most important synthetic Tellurium compound from the standpoint of its biological activity. It is a potent immunomodulator with a variety of potential therapeutic applications [2-4]. Continuing with our studies on MAOS [5-10] we draw our attention to this compound. The effects of microwave power, reaction temperature and time on AS101 synthesis were tested.

The first attempt, based on Albeck's synthesis by conventional heating [11], to get AS101 from TeCl_4 and NH_4Cl in ethylene glycol, was done by irradiating a mixture of these reagents at 120°C under solvent-free conditions. However, only decomposition of the reaction mixture was achieved. Thus, the reaction was checked using ethylene glycol in excess, both as reagent and solvent. The reaction was carried out in a sealed tube for 10 minutes in a 45% yield (Scheme 1); meanwhile by conventional heating 4 hours are required in similar yield.



Scheme 1

The procedure based on microwave irradiation has the potential of being applied to the synthesis of new AS101 derivatives in order to find the improvement of pharmacological properties.

General Experimental procedure

TeCl₄ (1.35 g) and NH₄Cl (0.387 g) were dissolved in ethylene glycol (5 mL). The mixture was MW irradiated in a CEM Discover monomode oven for 10 minutes at 80°C (80W). On cooling the reaction mixture, a white crystalline solid was obtained, washed with acetonitrile, filtered and vacuum dried. The solid was identified as ammonium trichloro[1,2-ethanediolato-O,O']-tellurate (706 mg, 45%). IR (*Golden-GateTM*): 3183 (NH), 1390, 1019, 894 cm⁻¹. ¹H NMR (300 MHz, DMSO-*d*₆) δ 4.36 (s, 4H, CH₂), 7.16 (t, 4H, NH₄⁺, *J*_{NH} = 50 Hz). ¹³C NMR (75 MHz, DMSO-*d*₆) δ 68,13. MS *m/z* (%): 292 (1), 290 (1), 260 (7), 258 (13), 256 (13), 254 (9), 224 (42), 223 (35), 221 (19), 200 (36), 198 (27), 196 (14), 190 (69), 188 (63), 186 (37), 165 (21), 163 (18), 161 (11), 146 (5), 130 (25), 128 (23), 126 (13). Anal. Calcd for C₂H₈Cl₃NO₂Te: C, 7.70; H, 2.58; N, 4.49. Found C, 7.85; H, 2.37; N, 4.42.

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