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Synthesis of 2- Amino-2`Bromo- Propane-1,3-Diol

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Abstract

Reduction of Bronopol into a corresponding amino compound has not been isolated so far. Several attempts were made to reduce bronopol into 2-amino-2`bromo-propane-1,3 diol. 2-amino-2`bromo-1,3-propane have been synthesized from Bronopol. This compound have been prepared by treatment of bronopol with Sn and HCl then heated. Synthesized compound have been isolated and purified. White solid was obtained. The compound was chartered by NMR C13NMR and IR spectroscopy. The newly synthesized compound have been evaluated for microbiological activity also.

KEYWORD: Bronopol. 2-amino-2`bromo-1,3-Propanediol,ether, and alcohol.

Introduction

Bronopol is a highly active antimicrobial compound whose chemical formula is 2-bromo-2-nitro-propane 1, 3-diol.Bronopol is a white pale yellow crystalline solid with strong odor. Bronopol is readily soluble in non-polar solvents but shows a high affinity for polar organic solvents. Bronopol is used in consumer products as an effective preservative agent, as well as a wide variety of industrial applications as an antimicrobial in cosmetics, external medicaments, shampoos and bath preparations. It is also used as a substitute for formaldehyde in chemical toilets. Bronopol has a broad spectrum of antibacterial activity and is widely used, at concentrations of upto 0.1% (w/v), as a preservative for pharmaceutical and cosmetic products [1-9].

Early work by Hodge, Dawkins and Kropp (10) and by Zsolnal (11) suggested that germinal bromo nitro alkanes had antifungal activity. The broad-spectrum antibacterial properties of 2-bromo-2-nitro-1,3-diol have been described in a preliminary communication by Croshaw, Groves Lessel (12) and in comparison, with other members of a series of antimicrobial aliphatic halogen-nitro compounds by Clark et al. (13)

Bronopol is used as a preservative in various cosmetic, toiletry and household preparations particularly because of its high activity against Gram-negative bacteria, especially *Pseudomonas aeruginosa* and other species. These organisms are common residents in water and as such can cause contamination and spoilage problems in cosmetics and toiletries (14,15,16,17).

Pseudomonas are frequently implicated, particularly in oil-in-water emulsions which contain a significant number of non-ionic surfactants (18,16,19). Bronopol is an effective antimicrobial preservative over a wide pH range. It is stable at acidic pH and is also useful as a liable antimicrobial preservative in alkaline media. Because of its broad-spectrum antibacterial activity, bronopol can also be used as an active agent, for example, in aerosol formulations. Bronopol has been reported to show persistent activity on

the skin, as reported by Marples and Kilgman (11); this contrasts with the fact that in vitro, it has been shown to have a weak growth-inhibitory effect on cultured human skin cells by Onoda and Saito (12). 2-Nitro-2-[4-(Phenyl imini)cyclohexa-2,5-dien-1-yl]Propane-1,3-diol was synthesized from bronopol(by T.Bhaskar and C.V.Mythili(20). 2-nitro -2-diethylamino-1,3-propanediol synthesized from bronopol by T.Bhaskar and C.V.Mythili(21). The nitro group of bronopol is reduced with Zn/HCl to from amino bronopol [22].

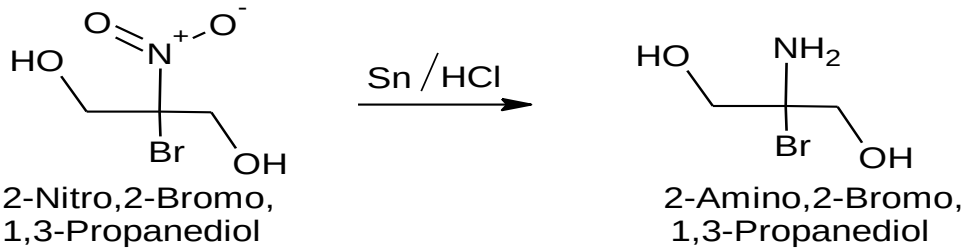
Materials and Methods

A.R. grade chemicals have been used for synthesis of 2-amino-2`bromo-propane-1,3-diol. Bronopol, Tin metal , hydrochloric acid ,alcohol and ether. TLC 60F254 pre coated plates were used and the spots were rendered visible by exposing iodine vapor. FTIR-4700 spectra for IR spectra. NMR spectra were measured from Brucker, 400 MHz Narrow Bore FT-NMR Spectrum.

Experimental

10ml of conc.HCL in small portions was added to a mixture of 1.0g of the nitro compound and 3g of granulated tin contained in a small (say, 50ml), flask fitted with a reflux condenser. Shaken the flask well to ensure thorough mixing during the addition of the acid. After 10 minutes warm under reflux at 100^0 with vigorous shaking until the nitro compound has dissolved and its odour is no longer apparent. (If the nitro compound dissolves slowly, add a few ml of ETOH). Cool the reaction mixture, and cautiously make it alkaline with 20-40 percent NaOH solution. Isolate the liberated amine by ether extraction.

Scheme



2-Nitro,2-Bromo, 1,3-Propanediol

2-Amino,2-Bromo, 1,3-Propanediol

Taken a readymade silica TLC 60F254 sheet. The product and reactants were spotted using capillary tube. Then it was placed in a solvent mixture bottle. The hexane and ethyl acetate in 3:7 ratio was used as an eluent. The sheet was dried and sprayed by potassium permanganate. The clear yellow colour spots were obtained. The R_f value was calculated. It confirms the product formation

The compound travels 0.9cm and the solvent front travels 4.5cm, the R_f is 0.2cm. Component B would be considered more polar because it has the lower R_f value.

Spectral Evidences

H1NMR CH_2O proton at δ 3.42, OH proton at δ 1.6 and NH_2 proton at δ 8.31 confirms the structure

C13 C-Br carbon at 25.67ppm,CH_2O carbon at 79 ppm,C-N carbon at 175.9ppm confirms the structure

IR 3464 $^{-1}$cm , 1463^{-1} cm 1403 $^{-1}$cm confirms the functional groups

Results and Discussion

Due to the stability of Bronopol it was highely important to search for synthetic methods which are able to reduce the compound. Bronopol was reduced by Sn/HCl to the corresponding amine. The amino compound was extracted by solvent and the structure was established by NMR and FTIR. The parent compound was an antibacterial and hence used as an insecticide and also as a preservative for many products but the amino compound loses its antibacterial activity. The NMR value for amino was like amide proton due to the electronegative atom attached with the carbon atom.

H1NMR CH_2O at δ 3.42 having 4 protons, OH at δ 1.6 having 2 protons and NH_2 at δ 8.31 having 2 protons.

C13NMR shows C-Br carbon at 25.67ppm,CH_2O carbon at 79ppm, and C-N carbon at 175.9ppm

FTIR 3464 $^{-1}$cm , 1463^{-1} cm 1403 $^{-1}$cm

Conclusion

In the present research work a new bronopol derivatives were synthesized and it may help to do research work in Bronopol derivatives with new directions of synthesis.

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