

An executive summary of the final report of the work done on the Minor Research Project of Aviva Maria F D'Souza entitled "Synthesis and characterisation of novel silanols derivatives and study of their biological and catalytic activity" sanctioned by UGC, vide sanction letter no. MRP(S)-052/13-14/KAMA002/UGC-SWRO dated 28/03/2014.

Compounds containing silanols are found in abundance in nature. They are formed from surface interaction of hydroxyl groups on silicate rocks, silica found near marine environments etc. These silanols found on surface of various particles and materials are useful in studying the interaction between the inorganic components and the natural specimens. In industries silanols are precursors in preparation of a no of polymers, silicones and sol gels.

During the synthesis of silanols only very dilute solutions are used in case of condensation processes, the use of reagents generating acids or bases are avoided so long as the product formed was in neutral system to prevent further reaction. Due to the high reactivity of the products formed, the reactions are carried out at low temperatures and reagents with bulky groups are used. Silanols usually undergo condensation reaction to attain stable siloxanes. This reaction results in viscous product, which on further heating eliminates the remaining water molecules giving a resin like methyl silicone. It is problematic to isolate silanols when stable siloxanes are formed and leads to degradation of the silanols obtained. This condensation process can be minimized by dilution and also by adding sterically stable substituents having silicon atom surrounded by three hydroxyl groups. The condensation of silanols can also be reduced by the removal of ionic impurities which catalyse the reaction. This can be carried out by using mild acidic or basic solutions.

The acidity nature of silanols can be studied by acid base titration and also by spectroscopic method. The stretching frequency of silanol can be measured by infrared spectroscopy. Silanol acidity can be linked to the shift in frequency due to the hydrogen silanol interaction. The stretching frequency is dependent on experimental conditions. A shift in frequency of the Si-OH stretching to low wavenumbers on hydrogen was seen, this depends on the type of proton acceptor and bonding. Studies showed that carbinols are less acidic than their corresponding silanols. The silanol acidity in solution tends to be similar for gas phase as well. Although silanols are usually acidic, it can be seen that they can also be basic in nature. Hence silanols they are seen to possess high hydrogen bonding between themselves and other compounds and can act as a proton acceptor or a proton donor.

Metalloprotease inhibitors are designed specifically from silanediols. Since the Si(OH)_2 group can replace an unstable C(OH)_2 group the silanediols are preferred. The activity of bioisostere in enzyme inhibition is similar to its carbon derivative. Silanols are very powerful biocides when used in smaller concentration. The effect is decreased further in case of spores as it is highly resistant. Higher concentration poses health risk and also long term side effects. Silanols on the other hand are comparative to organic alcohols with higher antimicrobial activity. They show higher hydrophobicity than the usually organic compounds due to low rotational energy. They have greater acidity in comparison as there is back donation of the electron from oxygen to pi bond. It was seen that silanols prevent the micro-organisms from adhering to the silica surface and preventing its accumulation.

Date :

Name & signature

Signature of Principal