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Sulphur trioxide is a strong Lewis acid and a number of addition compounds with organic tertiary bases and other electron donors have been isolated and their properties studied. Oxygen atoms in fatty acids, esters and ethers possess lone pair of electrons which they can donate.

Addition of sulphur trioxide to fatty acids is an exothermic reaction. This addition causes an increase in the specific conductivity of fatty acid which continues till maximum is attained at sulphur trioxide/fatty acid molar ratio 1:3. Further addition of sulphur trioxide causes specific conductivity to fall and it continues with increasing contents of sulphur trioxide till another break in the conductivity-composition curve is obtained at the molar ratio 1:2, thereafter no significant change in specific conductivity of the mixture is observed. In the case of isovaleric acid, the maximum and the only break is found at the molar ratio 1:2.

Change in molar volume on the formation of the diacid complex has been attributed to the formation of new chemical bond. The density and viscosity of the fatty acids increase on the addition of sulphur trioxide but densitometric and viscometric studies could not be carried out because of highly viscous nature of mixtures. Dielectric constants of fatty acids vary linearly with sulphur trioxide/fatty acid molar
ratio at low concentrations and dipole moment values have been calculated using modified Høeestrøm's formula. The molecular weights have been computed from the first break conductivity-composition curves. Acetic acid-sulphur trioxide mixtures have been electrolysed and hydrogen has been found to be one of the main constituents of the gases collected at the cathode. Protonic nature of acetic sulphur trioxide is further supported by the conductometric and potentiometric titrations where it behaves as a dibasic acid (58). This dianionic state of the solution and the formation of 1:3 compound can be explained on the hexa-covalency of sulphur and the structure of such compounds has been proposed to be as $\text{[RCOO}_3\text{SO}}_3^{-3}.3\text{H}^+$ where under the conditions only two protons are replaced by bases.

Since stability of sulphur tetrachloride where sulphur possesses a ten-electrons shell is questionable, 1:2 compounds have been explained on the basis of solvated protons structure.

In the case of esters, conductivity-composition curves show the formation of two compounds with methyl acetate, ethyl acetate and isobutyl acetate having sulphur trioxide/ester molar ratio 1:2 and 1:1. Densitometric, viscometric and reduced conductivity-composition curves confirm the results obtained from conductometric studies.

Other physical studies such as molar volume, viscosity, dielectric constant and dipole moment measurements have been carried out in similar manners and they suggest the formation of
highly ionic compounds. Ultraviolet absorption spectra of very
dilute solutions have been obtained. Validity of Beer's Law has
been observed in the cases of ethyl formate and ethyl propionate.
Electrolysis of the mixtures of sulphur trioxide and ethyl acetate
has been carried out in dilute as well as in concentrated
solutions.

Like fatty acids and esters, ethers also react with
sulphur trioxide exothermally. Dietherate has been isolated and
its physical properties studied. Energy of activation of ionic
migration as well as energy of activation of viscous flow have
been calculated by slope method. The ratio of the two has been
utilised in finding out degree of dissociation by the equation
developed by Greenwood and Martin (89b). Densitometric and
viscometric studies of mixtures of sulphur trioxide and dietherate
indicate the formation of monoetherate. Higher ethers give
tarry product when they react with sulphur trioxide.

Sulphur trioxide acts as an acid in selenyl chloride and
its use has been extended to acetyl chloride. Conductometric and
potentiometric titrations indicate the formation of two compounds
with acid/base molar ratio 1:2 and 1:1.

Formation of acetyl chlorosulphonate (CH₃CO SO₃Cl) on the
addition of sulphur trioxide in acetyl chloride is inadequate
to explain the formation of these compounds indicated. Moreover
the formation of (CH₃CO)₃S O₃⁻ 3H⁺ also lend support that acetyl acid
actually is (CH₃CO)₃SO₃Cl₂. Under the conditions, two acetylum
ions are replaced by basic ions.

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