**SUMMARY OF THE MINOR RESEARCH PROJECT-CHARACTERIZATION &CONDUCTIVITY STUDY OF POLYANILINE-CARBONNANOTUBE COMPOSITE WITH DIFFERENT DOPANTS(2011-2013)**

A polymer is a material whose molecule contains a very large number of atoms linked by covalent bonds, which makes it a macromolecule. The fundamental repeating unit in a polymer is known as "monomer". Although the term polymer is sometimes taken to refer to plastics, it actually encompasses a large class of compounds comprising both natural and synthetic materials with a wide variety of properties.Conductive polymers or, more precisely, intrinsically conducting polymers (ICPs) are organic polymers that conduct electricity. Such compounds may have metallic conductivity or can be semiconductors. Electrical conductivity of conducting polymers can be tuned from insulating to metallic through proper dopping. They have a conjugated structure with alternate $\sigma$ and $\pi$ bonds. The $\pi$ bonds are delocalized throughout the entire polymer network. This results in enhanced electrical conductivity.

Among this class of conducting polymers ,polyaniline have relatively higher conductivity, better stability, cost effectiveness and can be easily synthesized. Polyanilinegives semi conducting behavior with relatively high conductivity which can be enhanced by doping impurities .The ability of conducting polymer to change their electrical properties during reaction with various redox / oxidizing agents (dopants) make them applicable in various fields. It is an interesting field of researcht to vary conductivity of polymers by doping.

The area of nanoscience and technology has become increasingly important in the recent years. The nano regime is normally considered to encompass the range between 1nm to 100nm.The field of polymer Nan composites have attracted considerable attention as a method of enhancing polymer properties by nanoscale reinforcements. This concept is highly relevant for polymers as their application requires filler reinforcement. In view of the above factors , the study of polyaniline-carbon nanotube composite with different dopants is very important. Carbon nano tubes are extremely thin tubes with diameters of order of few nano meters but they can be thousands of times this dimension in length. These tubes have an extremely desirable combination of mechanical thermal and electrical properties. They have remarkable electronic properties and can be metallic or semi conducting depending on their structure and diameter. There is currently a great interest in exploiting these properties by incorporating carbonnano tube into some form of matrix.

In the present work,the sample polyaniline-MultiwalledCarbonnanotube(PANI-MCNT) composite is prepared using Hyrochloric acid( HCL) &Camphoursulphonic acid(CSA) as dopants& tried to compare the D.C.electrical conductivity of the composite with PANI prepared using HCL &CSA as dopants. The XRD analysis revealed that PANI is only partially crystalline with conducting metallic islands separated by large amorphous regions. This peak is very much sharper in PANI-MWNT composite because of much enhanced – conjugation in MWNTs.The FTIR analysis confirmed the formation of PANI. SEM image shows that aniline is polymerized between the wedges of MWNTs as well as on the tube surfaces.The rod like and coiled like structures of MWNTs are dispersed in the PANI matrix.PANImacromoleules absorbed at the PANI-MWCNT composite showed good conductivity compared to PANI samples.

HCl doped PANI showed a conductivity of 2S/cm.ButPANI(HCl)-MWNT composite showed a conductivity of 22S/cm.It is almost 3times greater than that observed for pristine MWNTs(7S/cm) used in the present work. Due to the large aspect ratio (length is very large compared to diameter) and surface area of MWNTs ,MWNTs may serve as conducting bridges between scattered PANI islands, boosting charge delocalization.The improved crystallanity of PANI with the addition of MWNT as evident from the XRD investigations is another reason for the increase in conductivity.CSA doped PANI showed a conductivity of 0.09S/cm.ButPANI(CSA)-MWNT composite showed a conductivity 20S/cm.In this case also, there is considerable increase in the conductivity of composite as compared to PANI. The sample prepared with HCL as dopant showed more conductivity than that of the sample prepared using CSA. Comparatively higher d.c. conductivity of HCL doped sample may be due to the presence of lighter dopant ions ie $CI^{-}$ions in HCL.The light weight $CI^{-}$ ions have greater mobility than $SO_3^{---}$ ions in CSA.