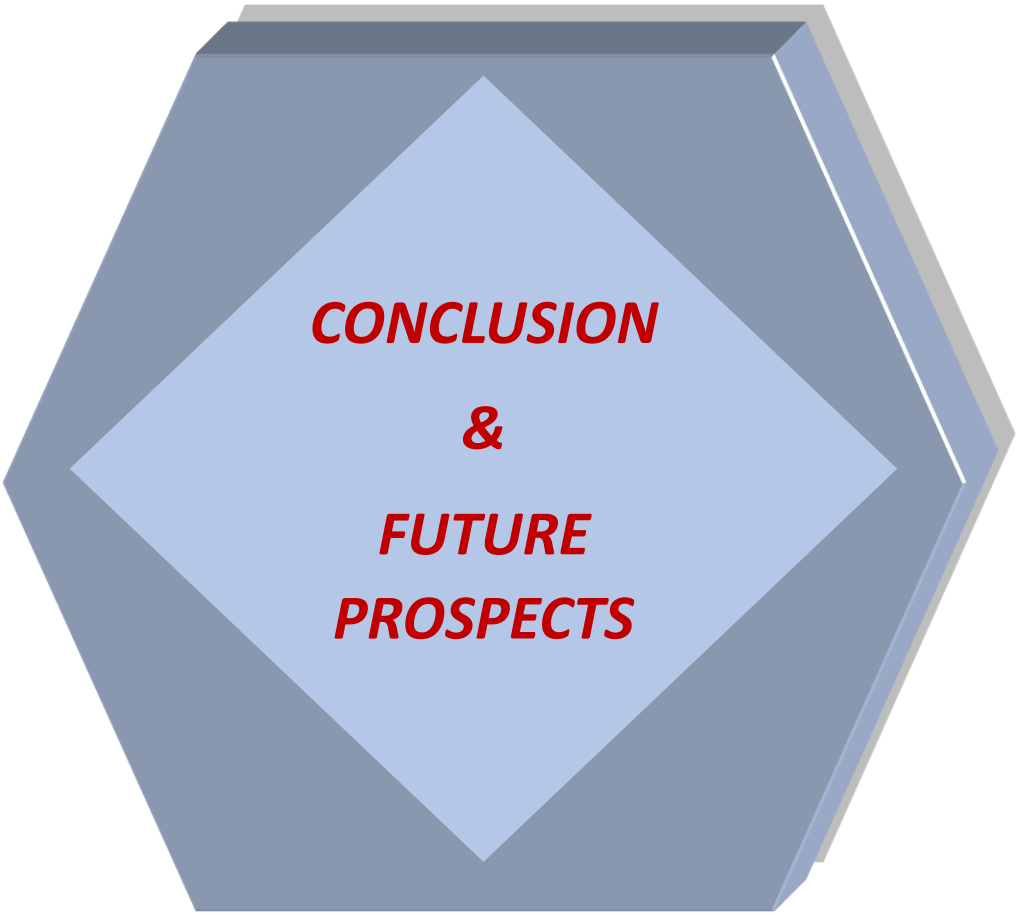
CHAPTER 5



5.1 CONCLUSION

The utilization of organogels as soft materials for diverse applications has gained significant traction due to their versatility with a multitude of organic solvents. The versatility of organogels is attributed to their ability to be tailored to specific applications by varying their chemical composition and processing conditions. Despite the increasing range of applications, the field of organogels remains relatively underexplored compared to hydrogels, a widely used soft material. The use of organogels has emerged as a viable solution in aqueous mediums. Several hydrophobic drugs, which often remain insoluble in water, are trapped within the three-dimensional network of self-assembled organic molecules. These gels, due to their adhesive nature, can adhere strongly to surfaces, even in the presence of water. This property has been exploited in various industrial applications, including marine coatings, biomedical devices, and oil spill remediation. The primary objective of this thesis is to develop a range of organogel systems suitable for use in aqueous environments. These systems are intended to serve as effective solutions for eliminating hazardous dye molecules, heavy metal ions, and organic solvents. The research involved a comprehensive investigation of the influence of various parameters on the surface adsorption of the organogels, coupled with a detailed analysis of their morphological, thermal, and mechanical properties.

The outcomes of the thesis are summarized as below:

1. Removal of organic solvents through a fatty acid grafted polyvinyl alcohol based organogel

- The hydrophilic nature of the polyvinyl chain changed from hydrophilic to hydrophobic with the increase in fatty acid content.
- The organogel was found to absorb organic solvents in their present state, the highest absorbency was found in carbon tetrachloride with 534.54%.
- Solvent absorption by the organogel followed second order kinetics model.
- The synthesized organogel shows a promising material to absorb seepage of organic solvents from the environment.

2. Grafted polymeric organogel as an effective medium for expulsion and purification of cationic dyes and organic pollutants from contaminated surface.

- The organogel observed solvent absorbency as well as dye adsorbency properties.
- The intake capacity of the solvent was found to be 10times greater than its original weight with highest absorption in acetic acid with 915%.
- The organogel successfully extracted dye molecules from aqueous solution through adsorption on surface. The fastest removal of dye molecule was recorded to be 60minutes in ethyl violet.
- Both absorption as well as adsorption studies followed second order kinetics while isotherm study for dye removal demonstrated Langmuir isotherm model.
- Reusability/Recyclability performed excellent result up to 10 cycles in both cases.

3. Polymeric organogel as an effective approach for eradication of heavy metal ions from the surface of groundwater through adsorption stratagem.

- Organogel prepared from PVA, SA, AMPS and MBA also exhibited adsorption of heavy metal ions from aqueous medium.
- The mechanism intricated electrostatic interaction between adsorbent and adsorbate molecules (metal ions) of varying sizes.
- Adsorption rate was found to be highest in Arsenic metal ions by 79.68%.
- The adsorption of metal ions followed second order kinetics as well as Langmuir model of isotherm.

4.Aluminum montmorillonite/polyaniline hybrid composite-based PVA organogel for expurgation of carcinogenic chlorophenols and congo red dye from defiled water sources.

- Hybrid organogel was synthesized using a composite (aluminium montmorillonite clay Al-MMT modified polyaniline PAni) and PVA.
- The prepared organogel shows enhanced swelling behaviour as the absorption of organic solvent was found to be maximum in *p*-chlorophenol. The organogel withstands up to 20 times its own weight as the swelling was found to be 2028%.
- The gel observed adsorption performance of congo red dye withstanding adsorption of 349.72mg/g by removing up to 99% from aqueous medium.

- The organogel also demonstrated selective adsorption of several anionic dyes from a mixture of dye solutions.
- The key interactions in the mechanism of dye adsorption involved electrostatic, π–π interaction as well as H-bonding.
- Kinetics model of second order as well as Langmuir model of isotherm were observed for adsorption process.

5.2 FUTURE SCOPES

The advent of the 21st century has observed a significant increase in research endeavours concerning organogel. Currently, organogels that have been synthesized are being employed for environmental purification. However, there is an opportunity to optimize the system by making modifications that would enable effective absorption of grease and contribute to the mitigation of marine oil spills. The potential utilization of these modified organogels in the realm of environmental remediation is extensive, and further investigation in this domain has the potential to yield notable advancements in the purification of contaminated sites.

Further scopes on the field of organogels may involve the following:

- Development of potential organogels as actuators in wearable robotics.
- Development of organogels for use as marine coatings to prevent the resistance of water improving the performance of ship's hull.
- Development of organogels as antimicrobial coatings to prevent the surface from microbes' contamination.