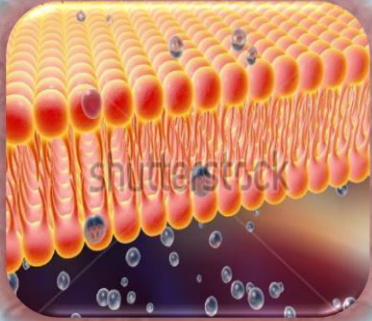




Production and Characterization of Membranes from Recycled Styrofoam for Wastewater Treatment

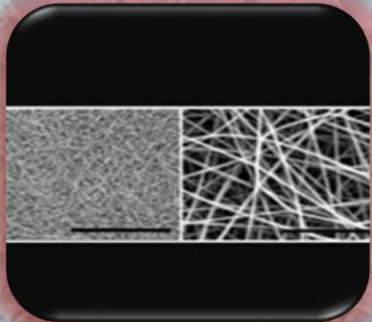
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Outlines:

- *Problem definition*
- *Project objectives.*
- *Styrofoam definition and uses.*
- *Problems of Styrofoam.*
- *Waste water and the treatment process*
- *Membrane*
- *Type of membrane*
- *Methodology*
- *Result and discussion*
- *Conclusion*

Problem Definition

- Styrofoam is a large source of hazardous waste.



Polystyrene is not usually recycled



The problem of waste water.

Project Objectives

Project Objectives

classify the produced membranes
according to applied pressure.

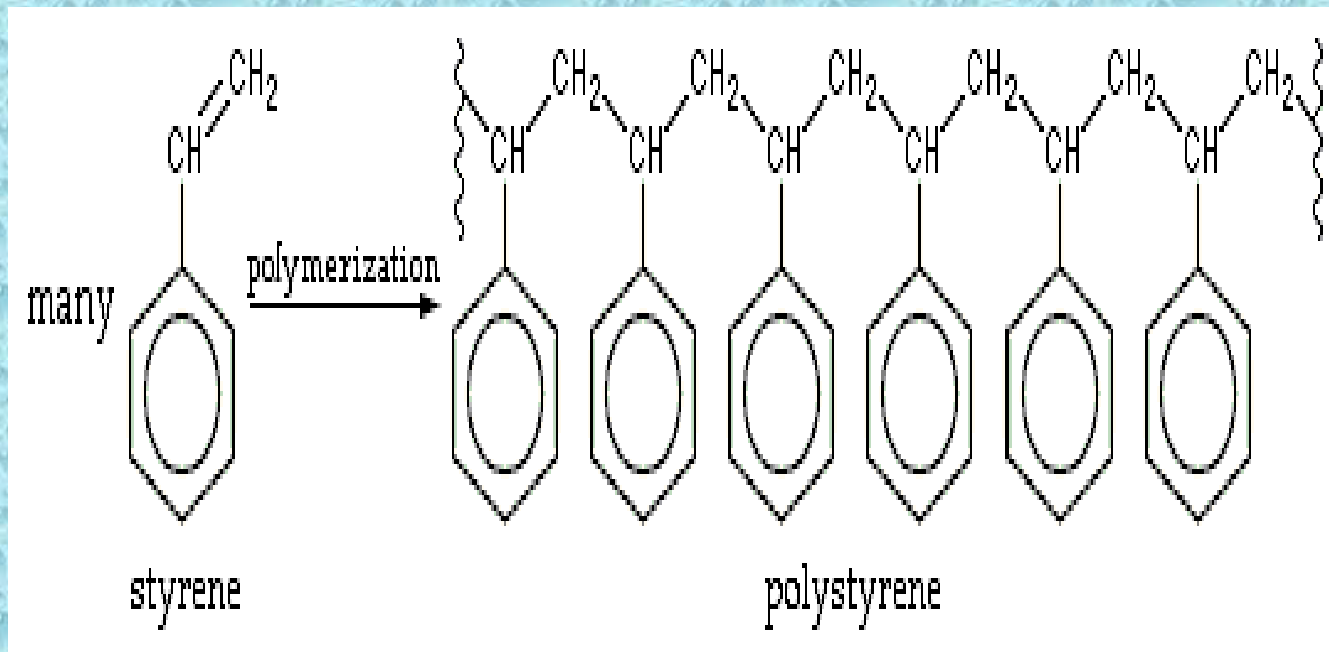
re-use Styrofoam to manufacture
membrane that is used for water
treatment



Introduction

Styrofoam Definition

Styrofoam is an expanded polystyrene (EPS) . It is made from styrene monomers. Also it is known as Plastic #6.



monomer of styrene structure

Uses of Styrofoam:

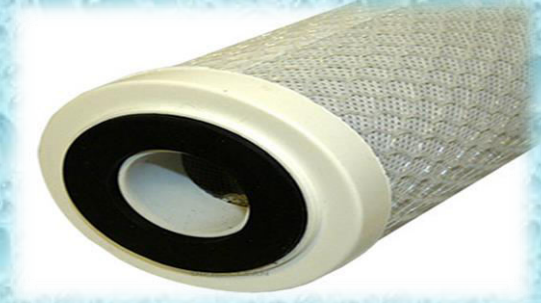


Problems of Styrofoam:

- ☐ When it is exposed to heat it lets off a fume that contains a type of neurotoxin.
- ☐ When it is put on microwave, or when hot coffee or tea is put on a Styrofoam cup, this poison will seep into food.
- ☐ It is non degradable product so it's bad for the environment.
- ☐ It is not recyclable.

Treatment Process of waste water

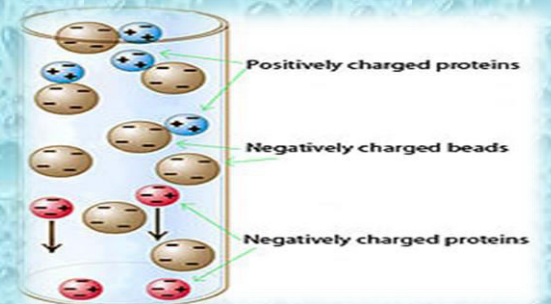
Activated carbon



Chlorination



Ion exchange



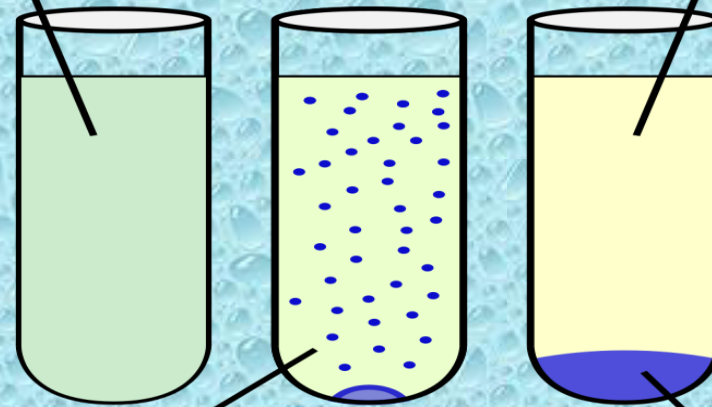
Chemical Precipitation

Solution

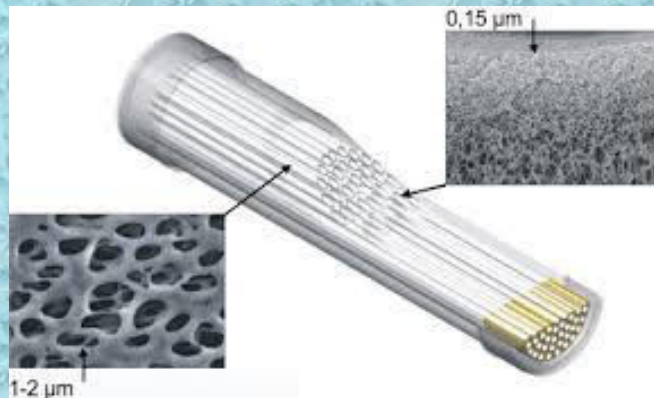
Supernate

Suspension

Precipitate

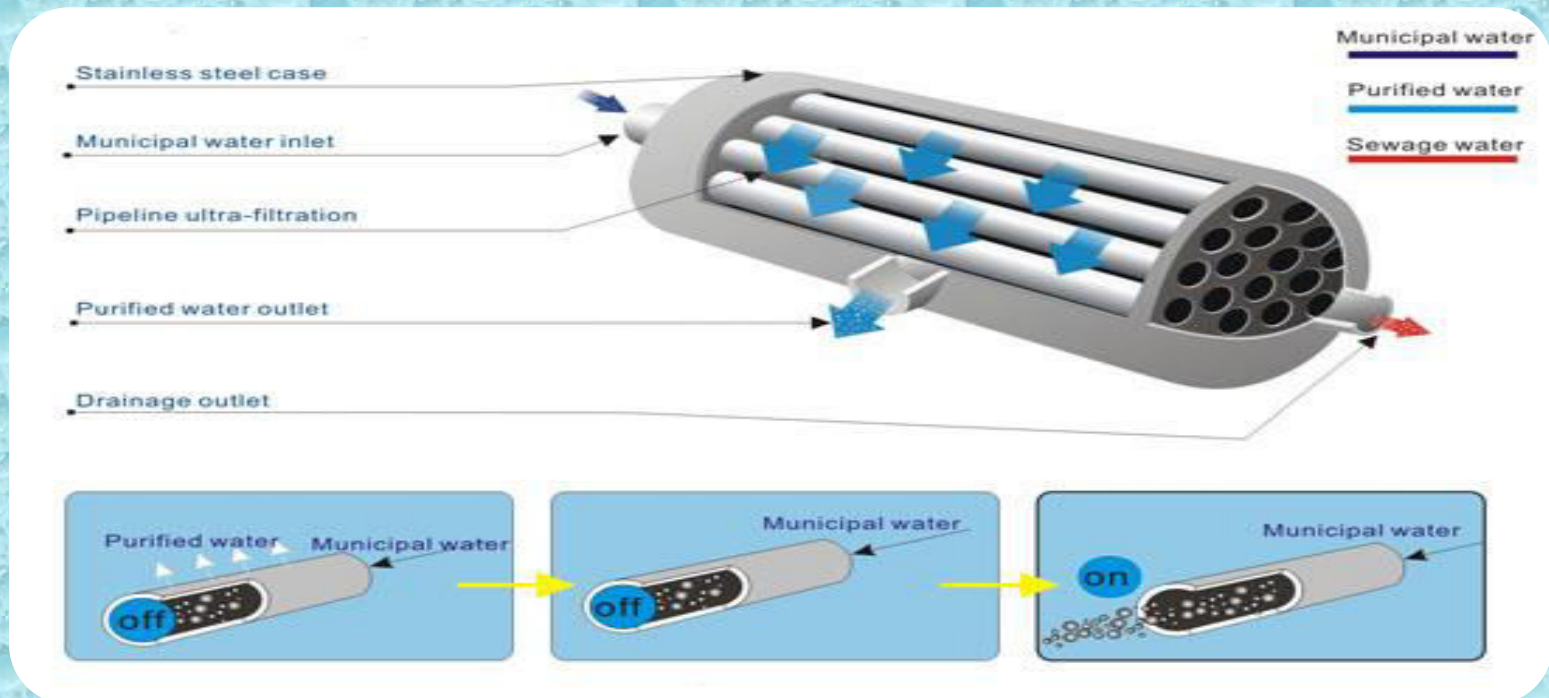


Membrane Filtration

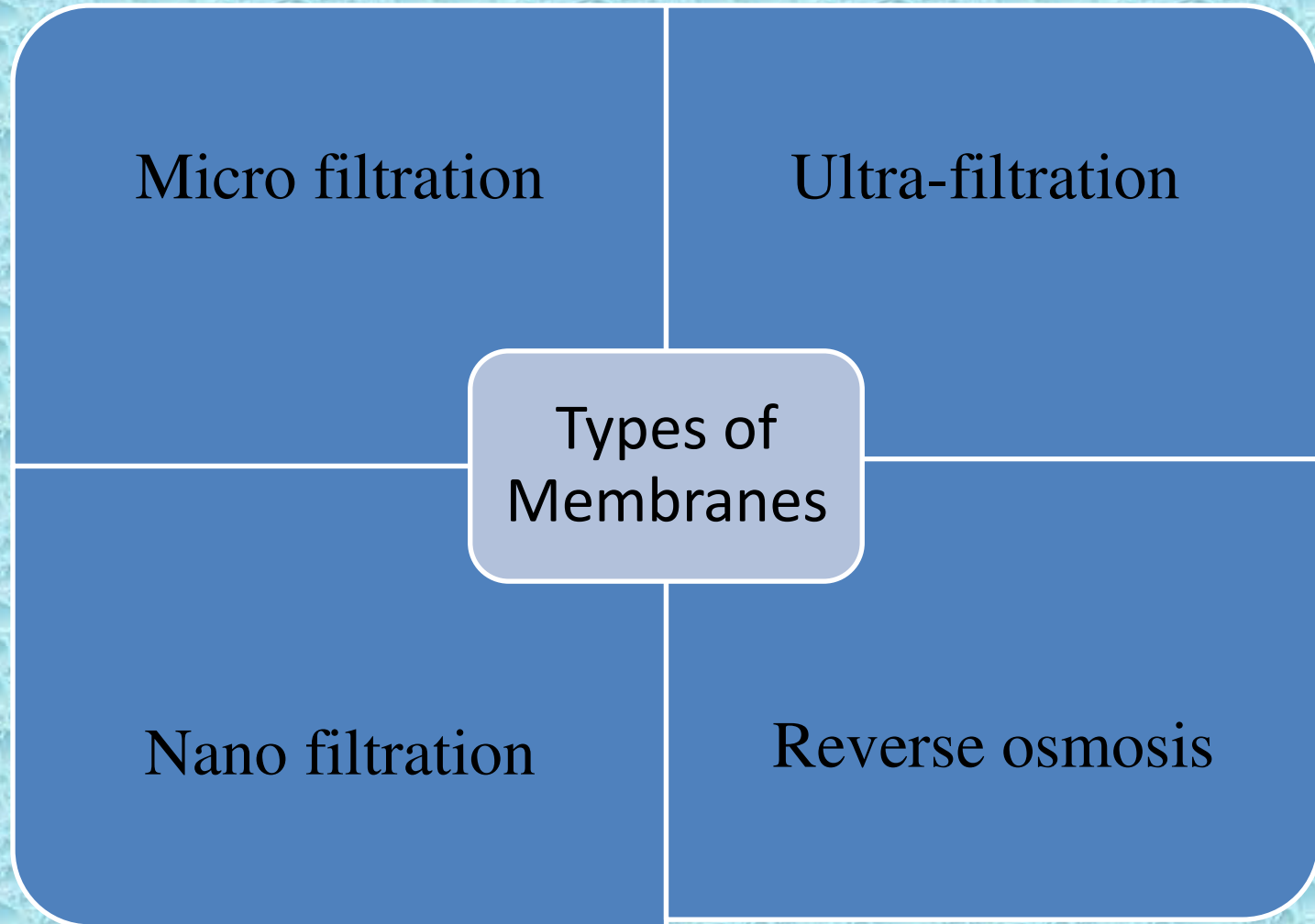


Membrane filtration

A membrane is a semi permeable barrier between two phases which prevents intimate contact. It restricts the movement of molecules in it in a very specific way.

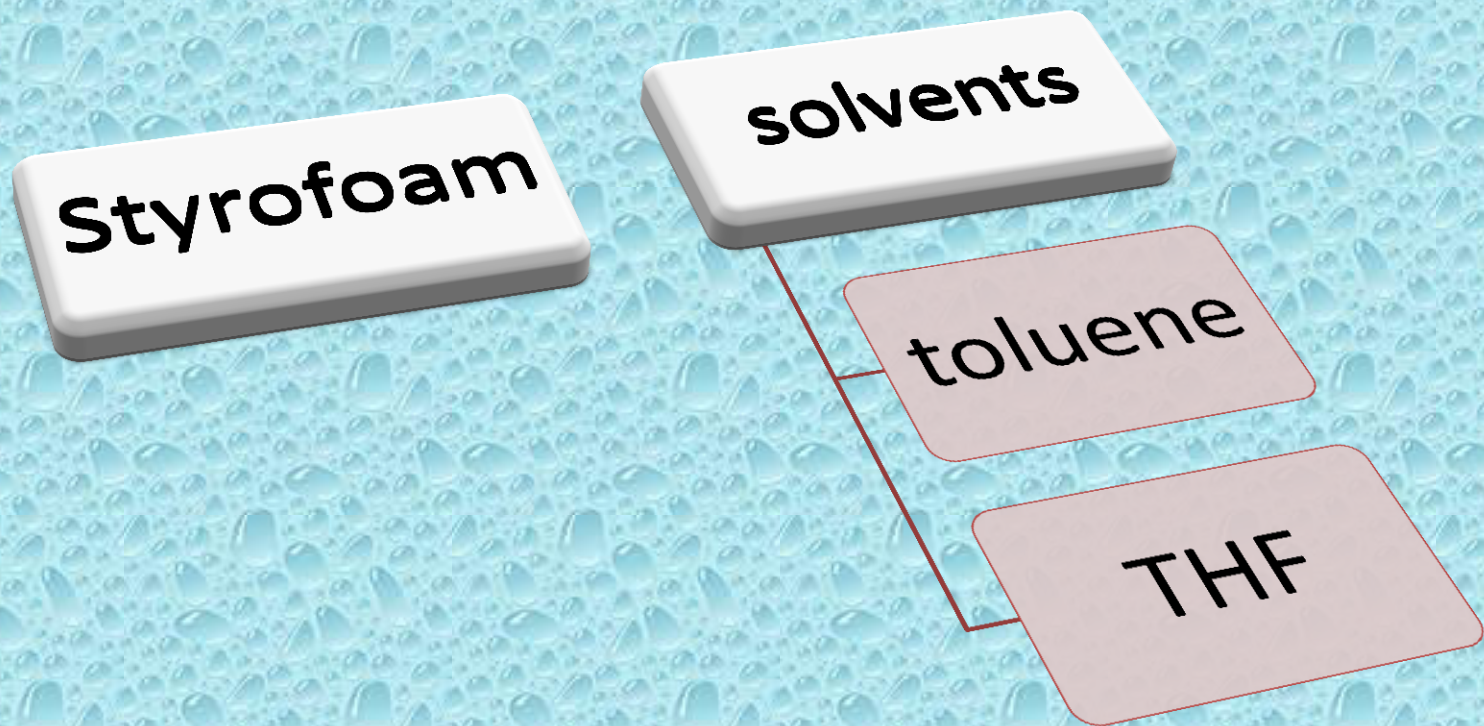


Type of membranes

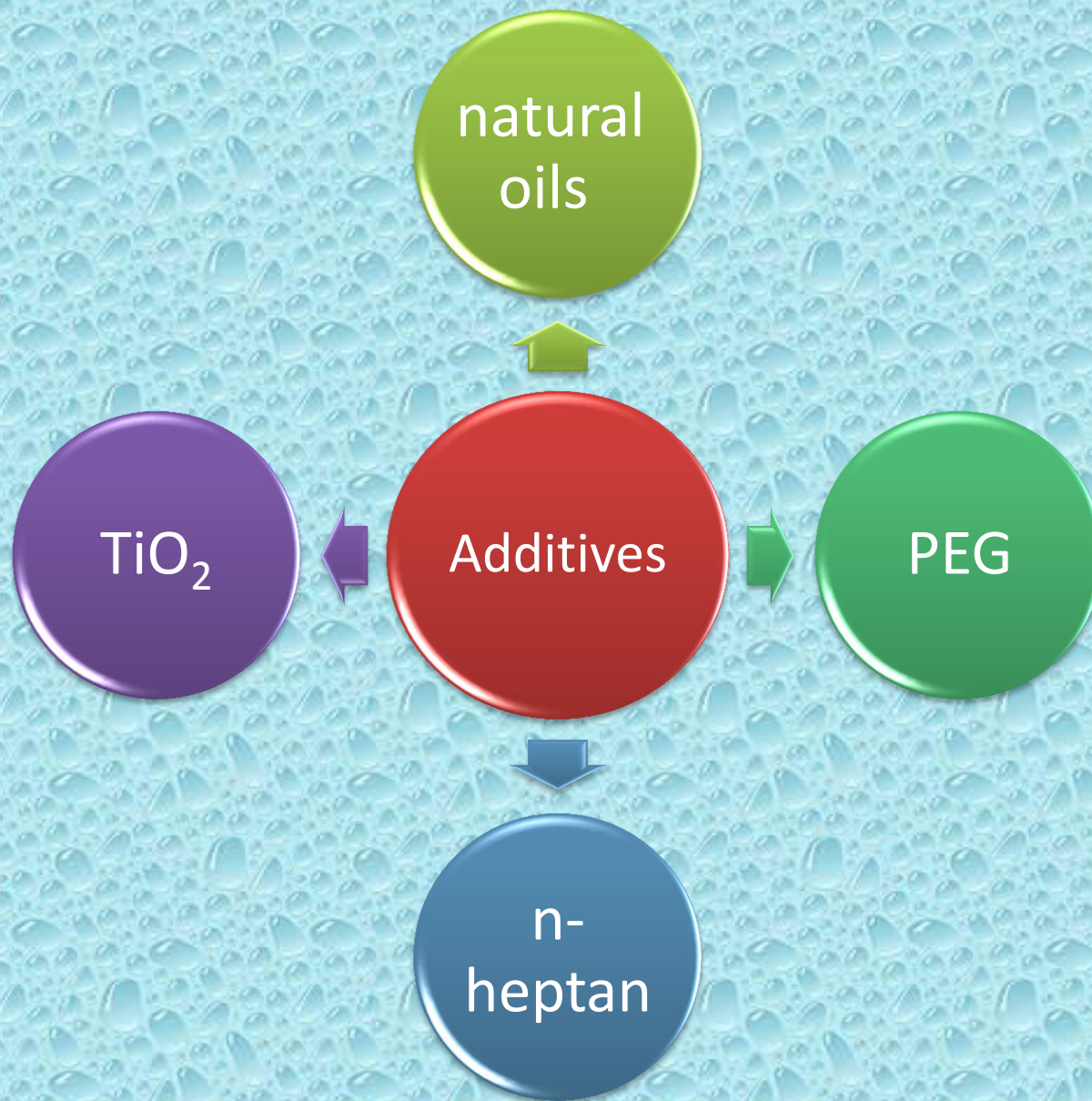


Methodology

Materials :

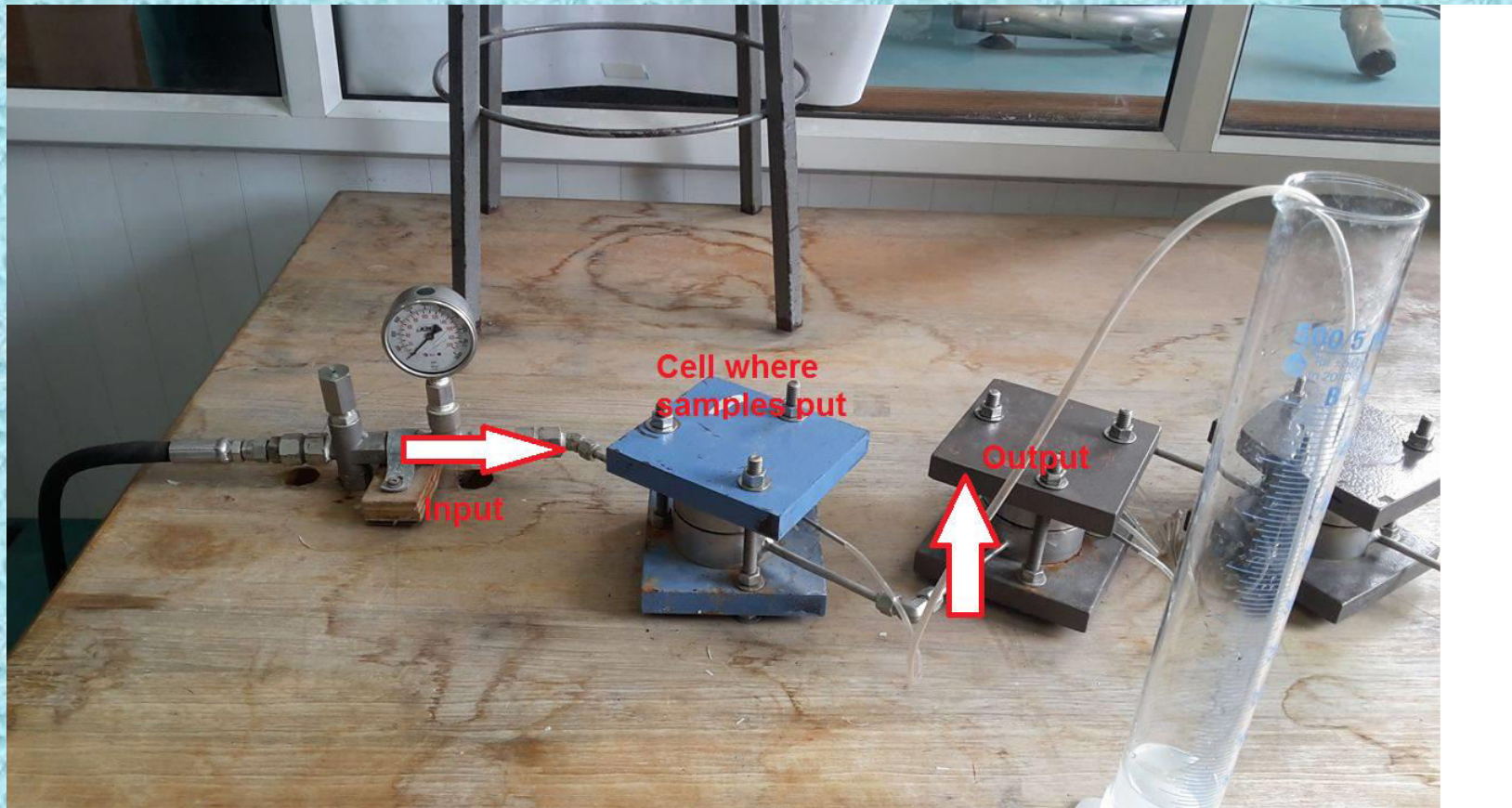


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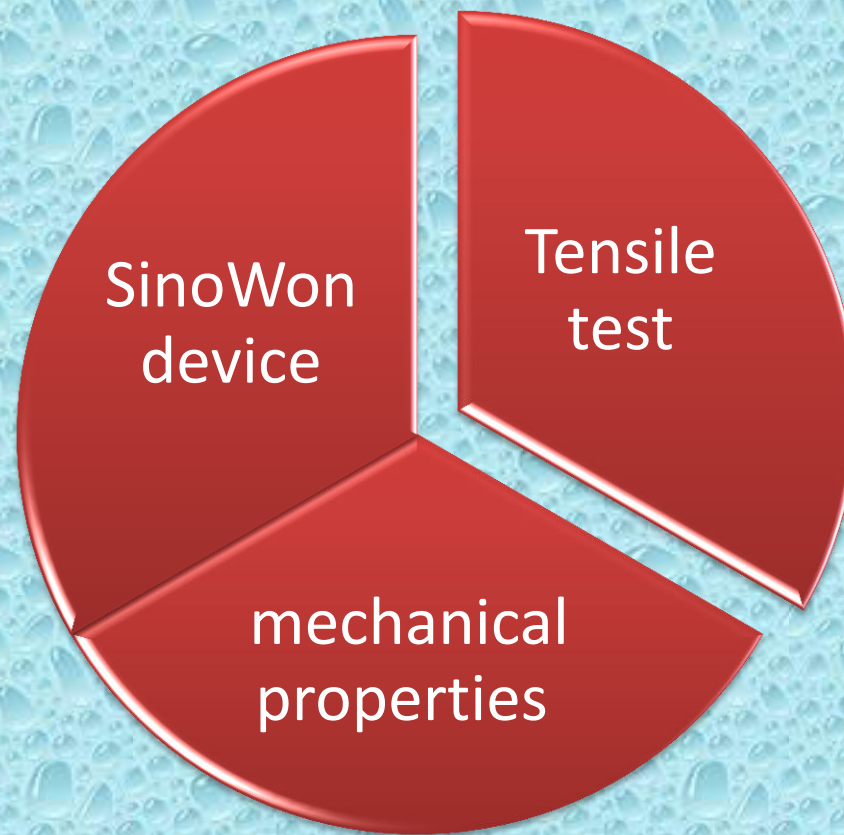
Testing :

Permeability Test



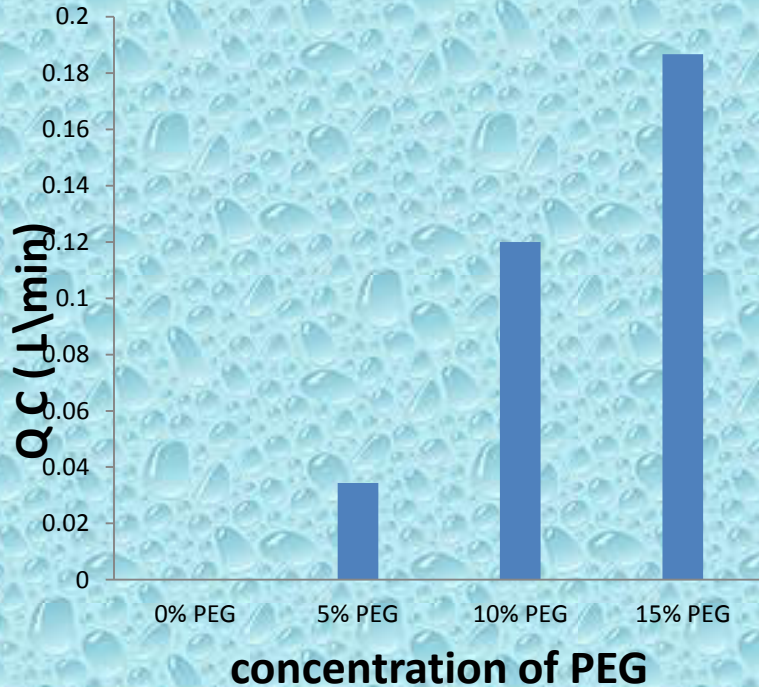
Continued

Tensile test

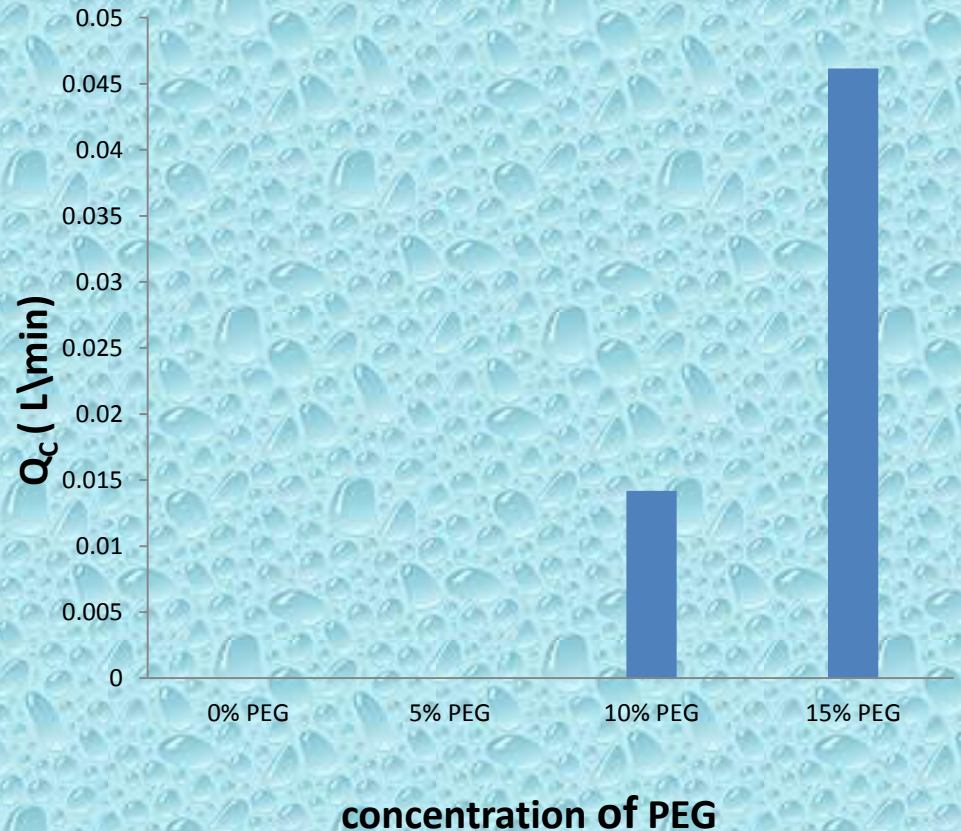


Result and discussion

Effect of PEG on permeability

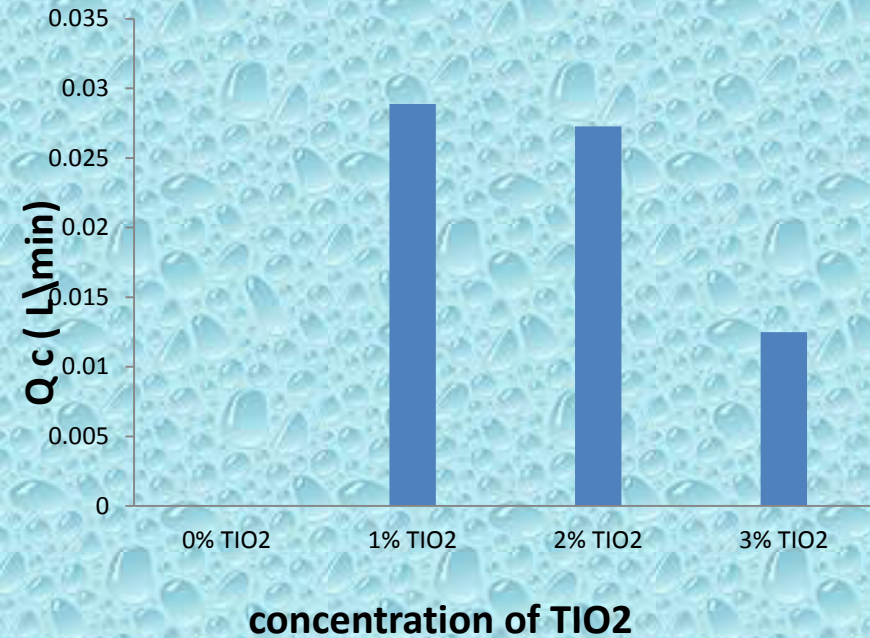


For toluene

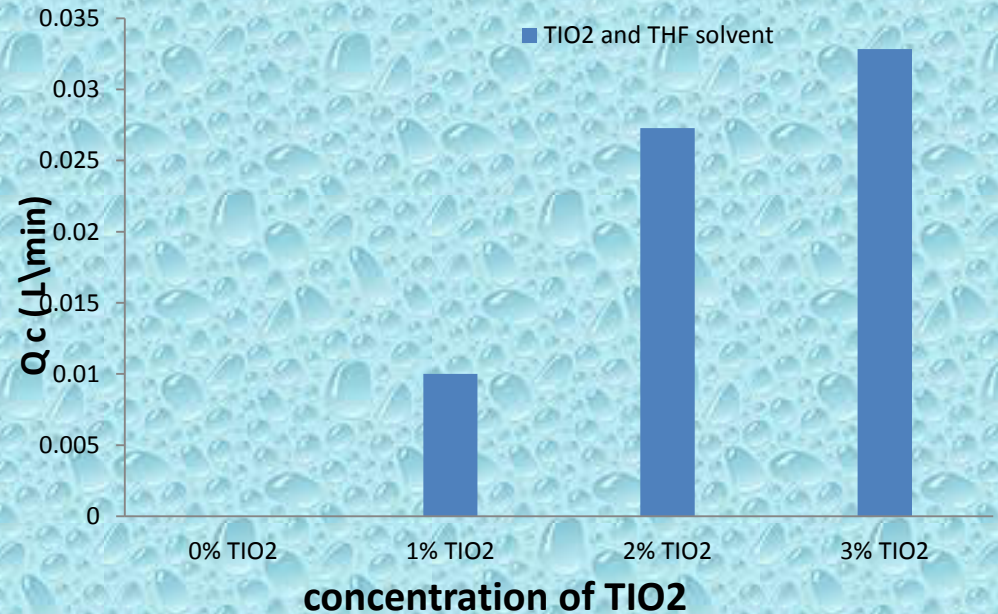


For THF

Effect of TiO_2 on permeability

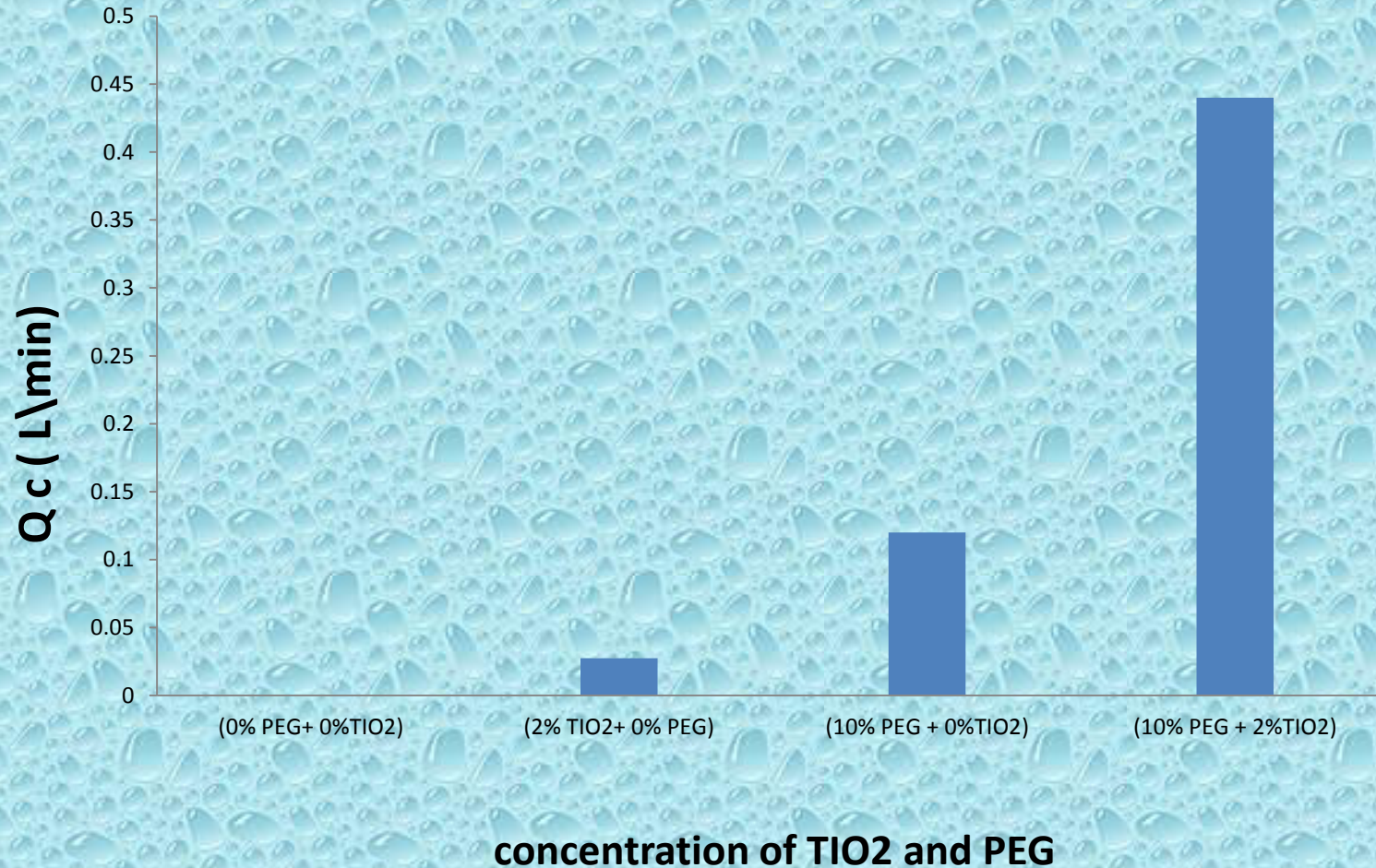


For Toluene

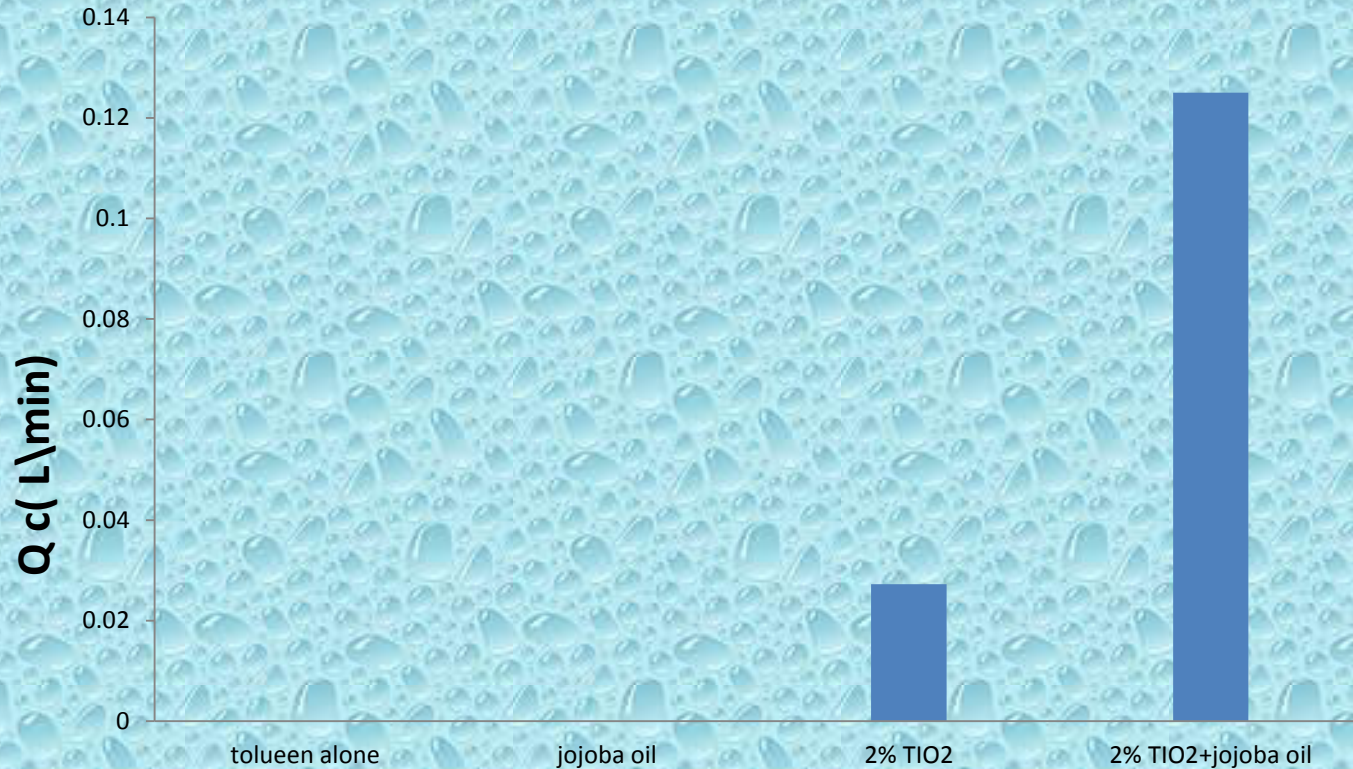


For THF

Effect of PEG with TiO_2 on permeability using toluene solvent

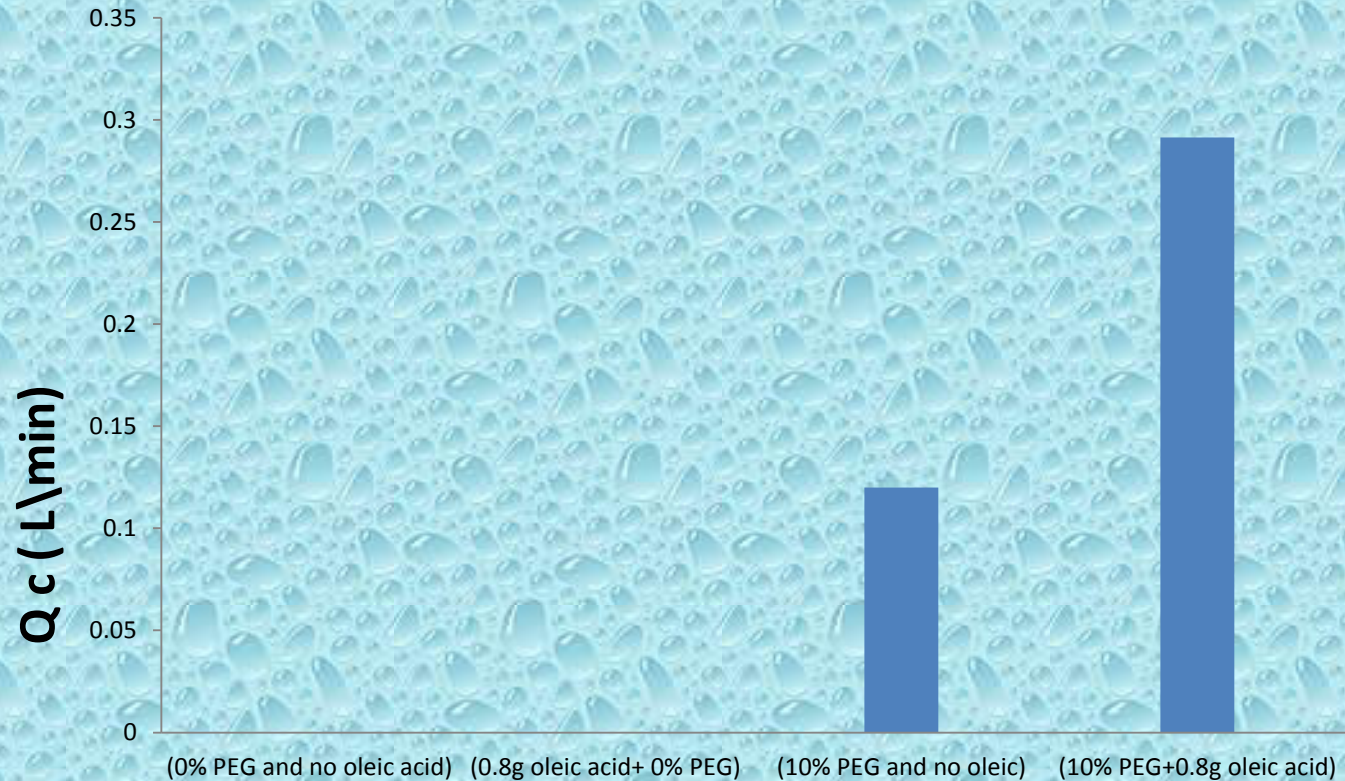


Effect of TiO_2 combining with Jojoba oil on permeability using toluene solvent



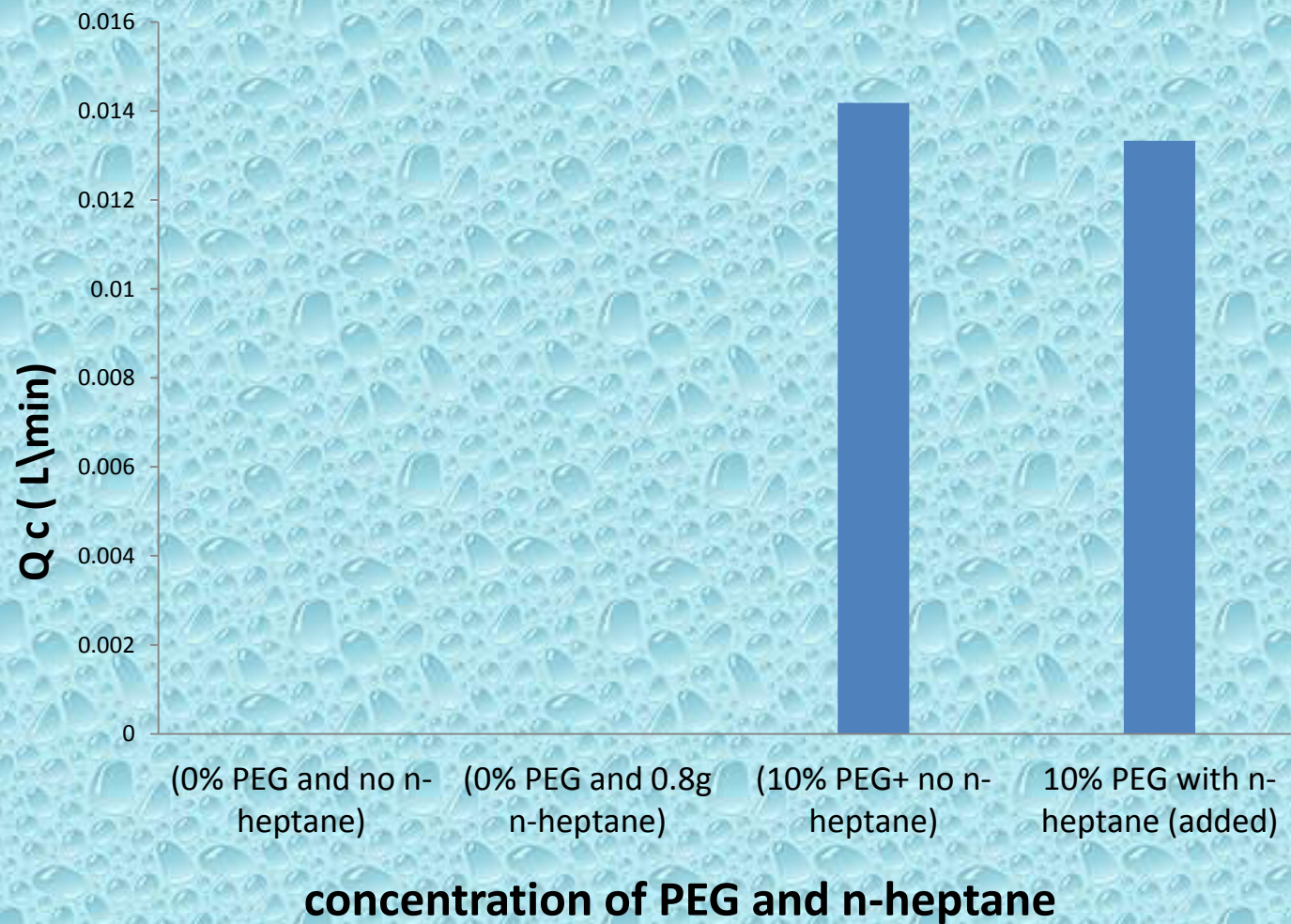
concentration of TiO_2 and jojoba oil

Effect of PEG with oleic acid oil on permeability of toluene

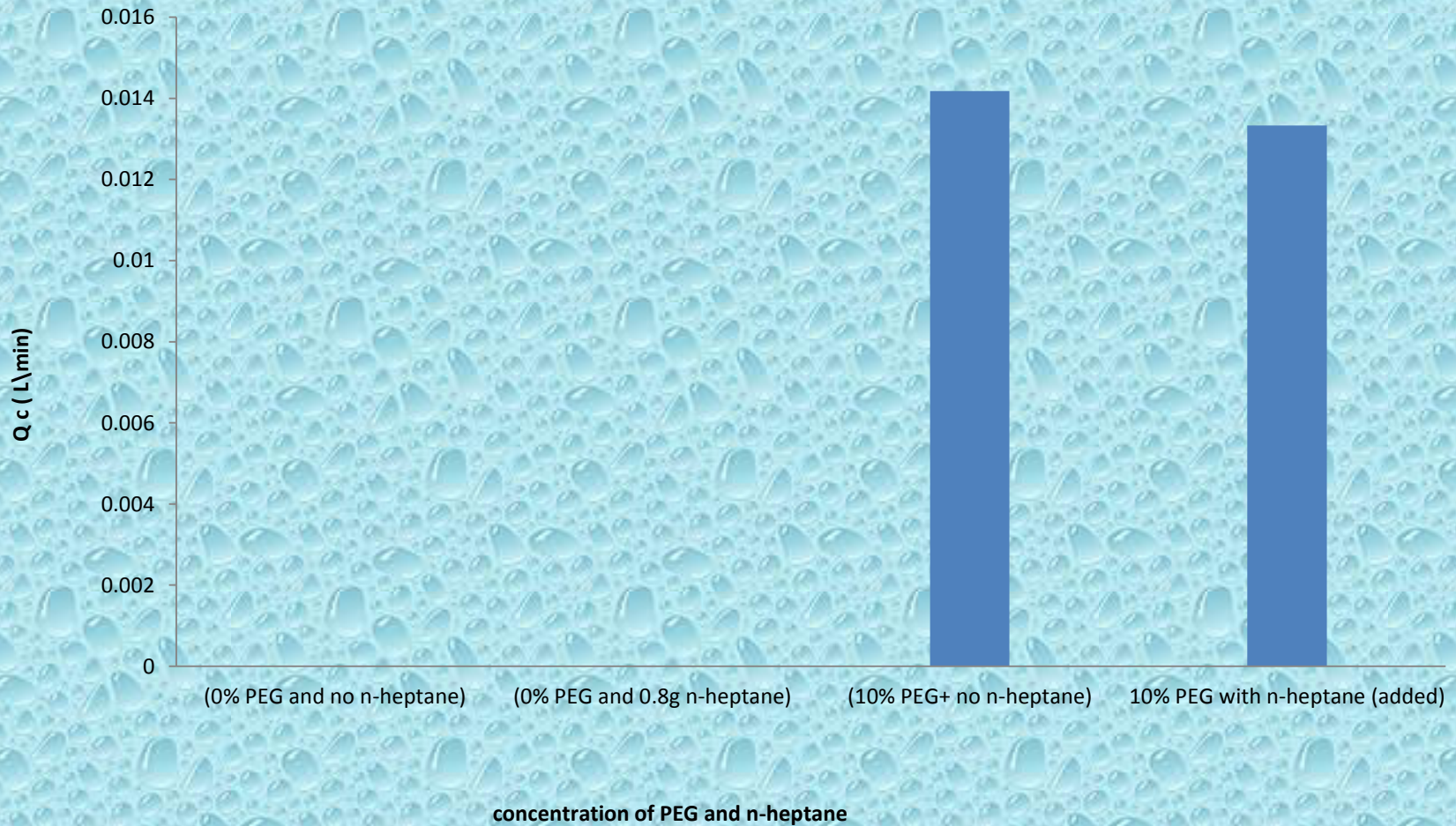


concentration of PEG and oleic acid

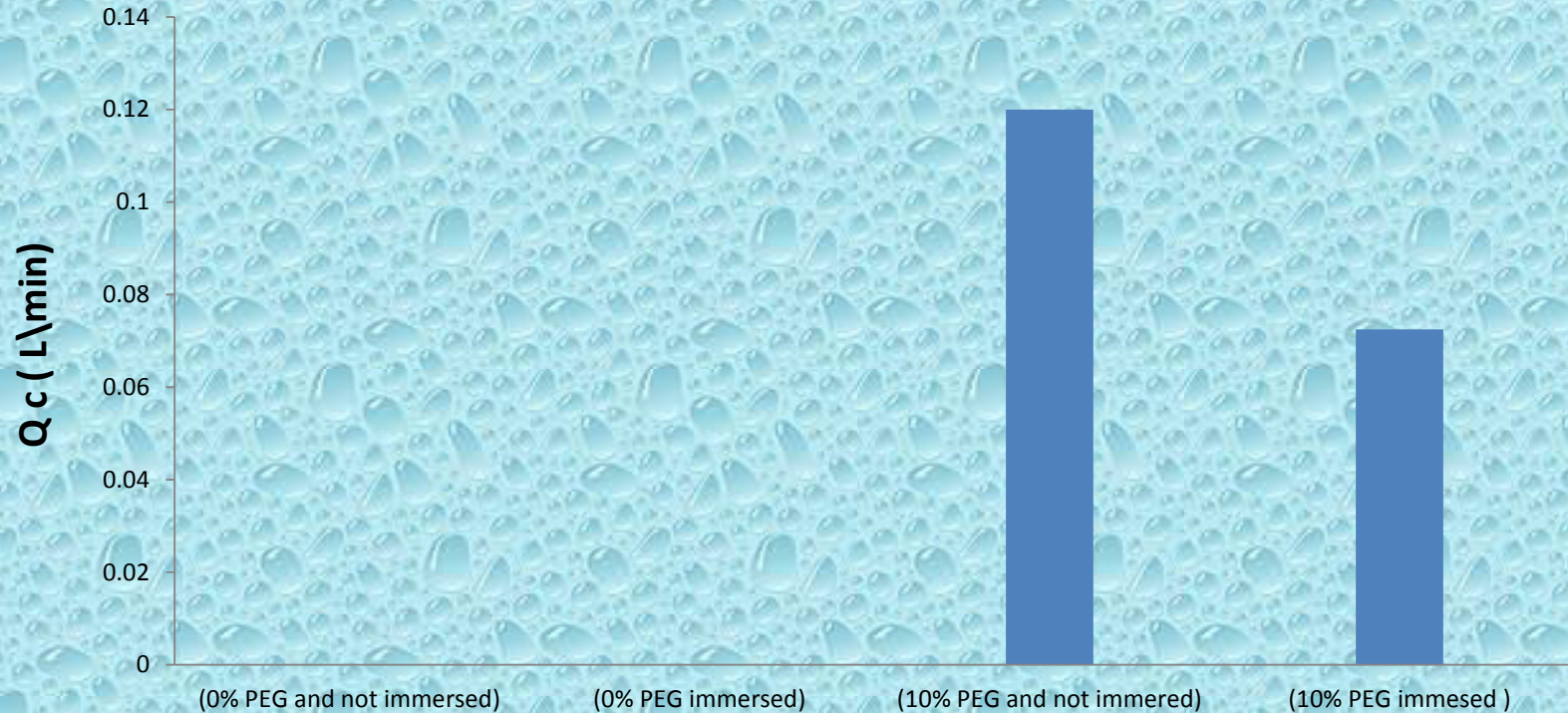
Effect of PEG with n-heptane (as additive) on permeability of toluene



Effect of PEG with n-heptane (as additive) on permeability of THF



Effect n- heptane immersion on Toluene-Styrofoam film modified with PEG



n-heptane immersion

Effect of THF and PEG immersed in water on permeability



Classification of membranes:

Based on previous results and depending on applied pressure, permeable membranes are classified to:

Solvent :Toluene		
Additives	Pressure(bar)	Type
5%PEG	10-15	NF
10%PEG	8-10	NF
15%PEG	14-18	RO
1%TiO ₂	45-50	RO
2%TiO ₂	45-50	RO
3%TiO ₂	45-50	RO
2% TiO ₂ and 10% PEG	8-10	NF
0.8 g oleic acid	40-50	RO

Continued

0.8g Oleic acid+10%PEG	5-10	NF
2%TiO ₂ +0.8g Jojoba oil	8-10	NF
0.8g n- heptane	40-45	RO
10% PEG immersed in n- heptane	10-15	NF
0.8g n-heptane + 10%PEG	40-45	RO

Continued

Solvent :Tetrahydrofuran		
Additives	Pressure(bar)	Type of membrane
5%PEG	40-50	RO
10%PEG	8-10	NF
15%PEG	20-25	RO
1%TiO ₂	35-40	RO
2%TiO ₂	35-40	RO

3%TiO2	35-40	RO
0.8g n-heptane with 10% PEG	20-25	RO
10% PEG immersed in water		MF
10% PEG immersed in n- heptanes	10-15	NF
0.8g n-heptane + 10%PEG	40-45	RO

Conclusion

- In this project different membranes were successfully prepared by dissolving Styrofoam in tow solvents.
- the sample that modified by adding TiO_2 to the casted film up to 1% weight percent were observed increased permeability and then decreased when more TiO_2 added in toluene solvent.
- The samples that dissolved in toluene solvent and modified by adding PEG to casted film up to 15% weight were observed of increased permeability.

➤ the permeability increased by adding either PEG or TiO_2 on samples dissolved in Tetrahydrofuran.

➤ the permeability of membrane was decreased with using n-heptane either as additive or media to immersion.

➤ Macro voids structure membrane was successfully obtained by immersed THF/Styrofoam film incorporating with PEG in water.

➤ Prepared membranes could be classified into different classes regarding the applied pressure

➤ Prepared membranes could be used in different waste water treatment applications

Thanks for listening

