SNS COLLEGE OF TECHNOLOGY

Vazhiamyampalayam,Coimbatore-35

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DEPARTMENT OF CHEMISTRY

COURSE NAME : 19CHB101- CHEMISTRY FOR ENGINEERS

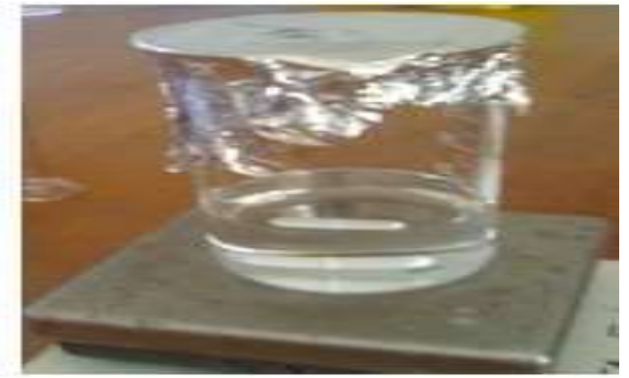
I YEAR / I SEMESTER

UNIT : 2. NANOCHEMISTRY

TOPIC : 2. SOL GEL METHOD

WHY SOL GEL METHOD?

- Bottom up method
- Better homogeneity
- Less energy consumption
- Economical method

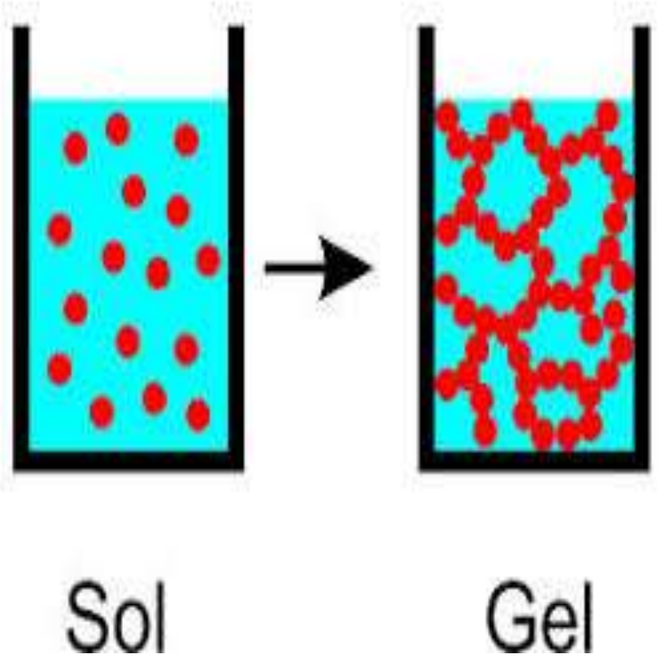


Sol

Gel

PROCESS

- Sol-gel is a chemical solution process used to make ceramic and glass materials in the form of thin films, fibers or powders .
- A sol is (a colloidal or molecular suspension) obtained from (starting materials) .
- A gel is a semi-rigid mass that forms when the solvent from the sol begins to evaporate and the particles or ions left behind begin to join together in a continuous network



SOL-GEL METHD CONSISTS SEVARAL STEPS

1)SOL FORMATION: Hydrolysis of metal organic reactant in an organic solvent that is miscible with water or inorganic salts in water results in formation of sol

$$M\text{-}O\text{-}R + H_2O \longrightarrow M\text{-}OH + R\text{-}OH \text{ (hydrolysis)}$$

2)GEL FORMATION: Condensation followed by polycondensation of sol results in the formation of the gel.

Water condensation: hydrolysed species condense releasing water.

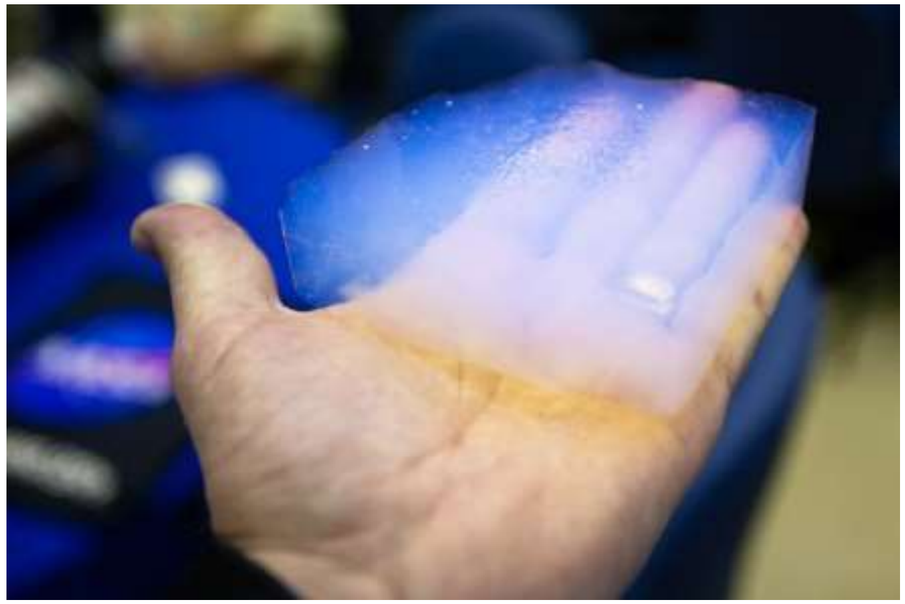
$$M\text{-}OH + HO\text{-}M \longrightarrow M\text{-}O\text{-}M + H_2O$$

Alcohol condensation: Hydrolysed species condense with unhydrolyzed species releasing alcohol.

$$M\text{-}O\text{-}R + HO\text{-}M \longrightarrow M\text{-}O\text{-}M + R\text{-}OH$$

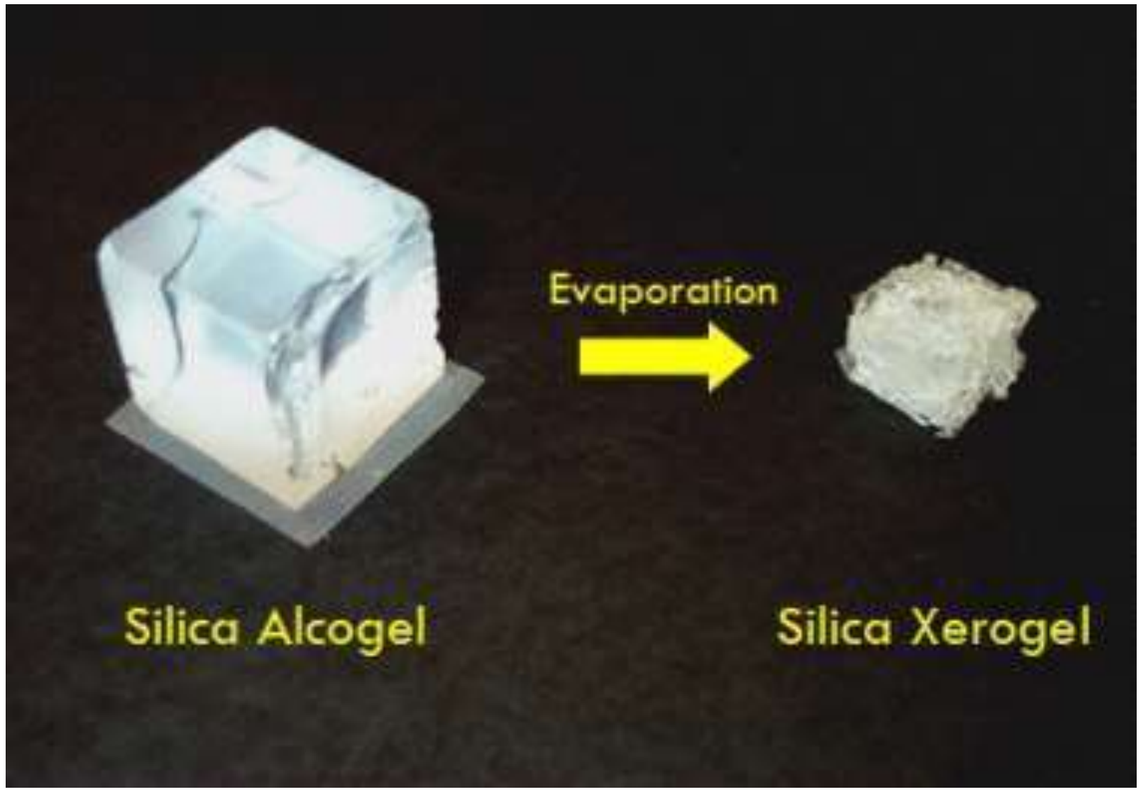
Aging of gel during which polycondensation reaction occurs, can exceed 7 days is critical to the prevention of cracks in gels that have been cast.

3)DRYING: It is nothing but removal of pore liquid



Under hyper critical conditions, upon drying the network does not collapse and the aerogels are formed.

Xerogel



Under ambient condition, upon thermal evaporation, shrinking of pores occurs and the xerogels are formed.

4)CALCINATION: During calcination, xerogel is heated up to 800 c. The pores of gel network are collapsed and remaining organic species are volatilized. The surface bound M-OH groups are removed, there by stabilizing the gel against rehydration. Calcination results in densification and decomposition of the gel.

5)**HEAT TREATMENT**: By heat treatment the material is shaped in to desired form such as films, fibres and nano sized powder.

Subsequently it can be converted into Ceramic material.


Quiz
time

PICTORIAL REPRESENTATION OF PROCESS

Sol

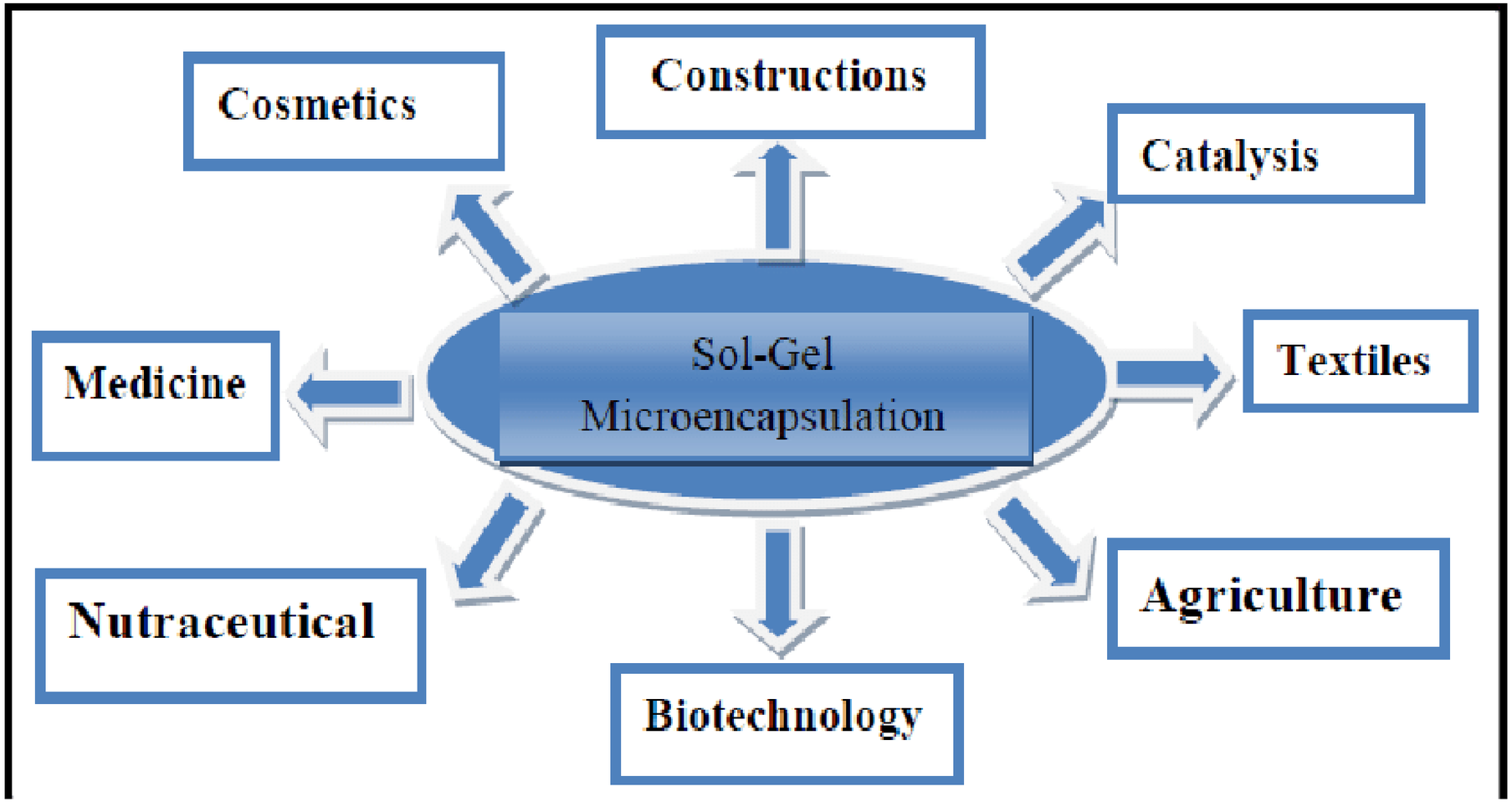
Gel

Dried gels

Grinding

Sifting

APPLICATIONS OF SOL GEL METHOD



ASSESSMENT

1. List out the various stages of gel formation

2. List out any two nanoparticles prepared by sol gel method

SUMMARY

REFERENCES

1. Dr.V.Veeraiyan, “Engineering Chemistry-II ”VRB Pub. Co. Ltd, Chennai.2016..
2. Wiley, “Engineering Chemistry”, John Wiley & Sons. InC, USA.
3. P.C.Jain & Monicka Jain, “Engineering Chemistry” , Dhanapat Rai Publising Company Pvt. Ltd. 2017.

THANK YOU