Smart /Functional Specialty Fibres

Module 7: FAQ

Q1. What are smart or responsive Fibres?

Ans: Textile Fibres that can sense, respond and adapt to a small change in external stimuli.

Q2. Give example of two monomers (name and chemical structure) that are suitable for making responsive polymers.

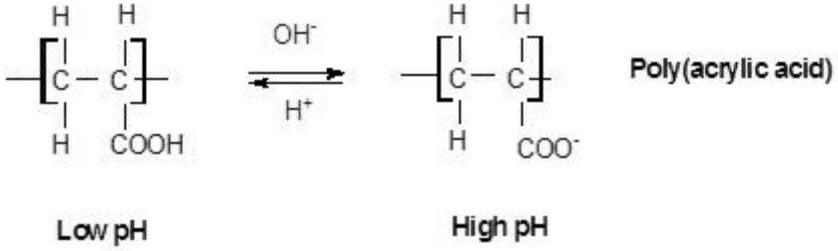
Ans: N-isopropyl acrylamide, Acrylic acid

Q3. Explain how the extent and time of response of responsive fibres can be controlled?

Ans: The extent of response can be varied by varying degree of crosslinking while the time of response can be controlled by increasing the surface area for enhancing the diffusion of water.

Q4. Write the structure of repeat unit of pH responsive polymer and the nature of response exhibited by it.

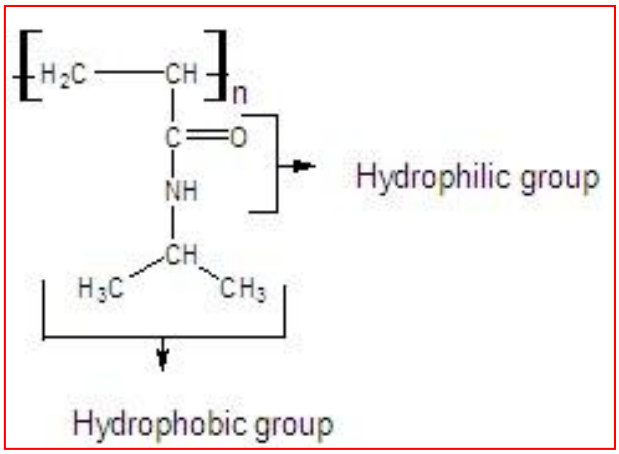
Ans:



With increase in the environment pH, degree of ionization in carboxylic acid groups undergo dramatic change at a specific pH called pK_a and there is a transition in the polymer chains from collapsed hydrophobic state to soluble hydrophilic state.

Q5. What type of structural unit is required in a polymer to exhibit Thermo-responsive property? Explain with the help of an example.

Ans:



For showing response to temperature, the polymer must have both hydrophilic and hydrophobic groups in the structure. Below the transition temperature (also known as Lower Critical Solution Temperature (LCST)), the hydrophilic interactions (the hydrogen bonds formed between water molecules and N-H or C=O groups of PNIPAm) dominate and polymer becomes soluble in water, while above this temperature hydrophobic interactions dominate and polymer chains collapse and the polymer becomes insoluble in water.

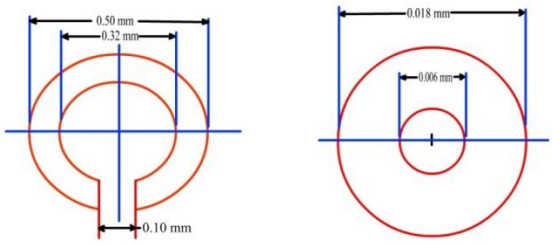
Q6. List four applications of smart polymers.

Ans. These can be used for:

1. Controlled release
2. Self healing
3. Artificial muscles
4. Separation and purification

Q7. Draw the spinneret shape and profile for hollow circular fibre

Ans:



Q8. What are the advantages of non-circular fibres?

Ans. Non-circular cross-sections have greater lusture, high covering power, excellent capillary and wicking properties, improved handle, light-weight and warm preservation.

Q9. What are the factors that increase the possibility of reshaping to produce non-circular fibres?

Ans. Some factors that increase the possibility of reshaping involve:

1. Lowering of melt viscosity
2. Increase in spinning temperature
3. Lowering of throughput rate
4. Increase of spinning speed as it reduces the time available for solidification
5. Contour of spinneret

Q10. Why are bicomponent fibres important?

Ans. These fibres can be used for specific applications where the functional properties of both the components are necessary.

Q11. What are the different types of bicomponent fibres

Ans.

- Core-sheath
- Side by side
- Segmented pie or citrus fibers
- Islands in the sea

Q12. For bulkiness which type of spinneret geometry is suitable

Ans: The eccentric type

Q13. Define nanofibres.

Ans. Fibres finer than 500 nm are commonly called nanofibers.

Q14. Why do nanofibres show extraordinary properties?

Ans. Nanofibres have a very large surface area to volume ratio and the increase in surface area is as large as 10^3 times of that of a microfiber. This increased surface area can result in a remarkable increase in capacity to attach or release functional groups, absorbed molecules, catalytic moities, etc. Therefore, these exhibit superior properties.

Q15. What are the different techniques for making nanofibres?

Ans: Nanofibres can be prepared by following techniques

- Drawing
- Template synthesis
- Self assembly
- Phase separation
- Electrospinning:

Q16. Why polymeric nanofibres are ideally suited for application in wound dressings and protective textiles?

Ans: For Wound Dressing: electrospun polymer nanofibres are treated as tissue scaffolds which enhance cell growth and proliferation

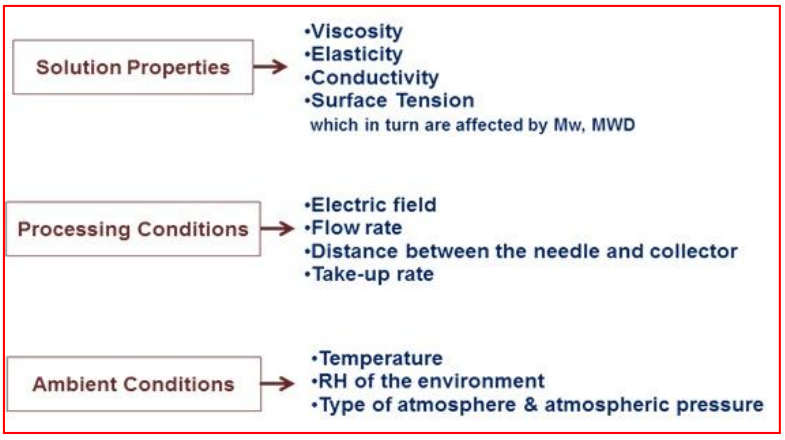
For Protective Textiles: The surface chemistry of nanofibres can be tailored to absorb toxic substances/molecules. Due to its appropriate pore size, these do not allow microbes, bacteria or viruses to pass and infect the wound.

Q17. What are the essential components of electrospinning process? Explain the parameters that affect the morphology of fibres formed? Explain what are the conditions required for making bead-less nanofibres.

Ans: Essential components of e-spinning:

- A syringe pump for controlled delivery/flow of polymer fluid
- A high voltage supply and
- A grounded or oppositely charged collector

Parameters affecting the fibre morphology:



The concentration of the polymer should be above critical concentration which depends on the molecular weight and nature of the polymer

Q18. What are defects- droplets and beads in electrospun fibres?

Ans: Droplets are formed if the polymer concentration is low and the drplet at the spinneret is not able to extend and results in droplets. The beads are observed if the electrospun fibres are not fully stretched.