Polycaprolactone (biodegradable polymer) is used in various applications due to its biodegradability and cost-effectiveness. Electrospinning nanofibers is a cost-effective method to produce nano-fibers that can be engineered to mimic natural tissue matrixes. Cells respond favorably to biodegradable polymer nanofibers because they can range from nanometers to millimeters, mimicking the natural fibrous structures of tissues and organs.

**Motivation**
- Develop and test polymer-drug & polymer-dye nanofibers to measure diffusion rates and chemical interactions between polymer mix materials.
- Design a teaching module for high school chemistry students that incorporates research applications in nanotechnology.

**Background**
- An encapsulated drug in a biodegradable polymer nanofiber can be used for controlled release of a drug for a specific targeted site.
- Since nanofibers have a high surface area-to-volume ratio and small diameters, a greater amount of mass can be transferred across a short diffusion passage length.
- As the polymer degrades over time, the trapped drug will be released.
- Understanding the rate of diffusion and chemical interactions between the drug and polymer will help advance the use of nanofibers as drug delivery materials.

**Fibers**
- Tissue and organs are made up of organized fibrous structures.
- Fibers range from nanometers to millimeters.
- Cells respond favorably to biodegradable polymer nanofibers.
- Polymer nanofibers can be engineered to mimic natural tissue matrixes.
- Electrospinning nanofibers is cost effective.

**Experimental Setup**
- Collect nanofibers
- Place sample in H₂O for diffusion experiments
- Electropin polymer-dye or polymer-drug nanofibers
- Measure the fluorescence intensity
- Export the Data
- Sample aliquot used to measure fluorescence

**Chemical Interactions**
- Polycaprolactone (PCL) affects Rhodamine’s ability to fluoresce due to intermolecular interactions.
- However, in nanofibers, the low concentration of PCL does not significantly affect fluorescence.
- Electrospinning does not affect the integrity of camptothecin.
- Bioactivity of the drug and chemical interactions between dye and polymer were confirmed using FTIR.

**Diffusion Study of Rhodamine**
- As the PCL degrades over time, the amount of fluorescence increases.

**Results & Conclusions**
- Polymer-fluorescent dye nanofibers are used to model the diffusion rates since the drug is intrinsically fluorescent.

**Future Work**
- Continue diffusion studies of polycaprolactone-camptothecin nanofibers.
- Develop nanofibers for bioengineering tissue matrixes.
- Optimize parameters for electrospinning of nanofibers.

**Teaching Module Plan**
- Students will perform hands-on activities aligned with research applications in nanotechnology that incorporates various science disciplines.
- Students will test, defend & reevaluate nanofiber polymer products created using electrospinning apparatus as they develop a deeper understanding of electro-chemistry.
- Students will examine various polymer materials.
- Students will perform hands-on activities aligned with research applications in nanotechnology that incorporates various science disciplines.

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