

### 1. Objective

- Scale up the existing laboratory synthesis of SDC-Agarose biopolymer film to a manufacturing facility capable of producing a portion of plastic film demand.
- Evaluate economic feasibility, as well as safety and environmental aspects of the design.

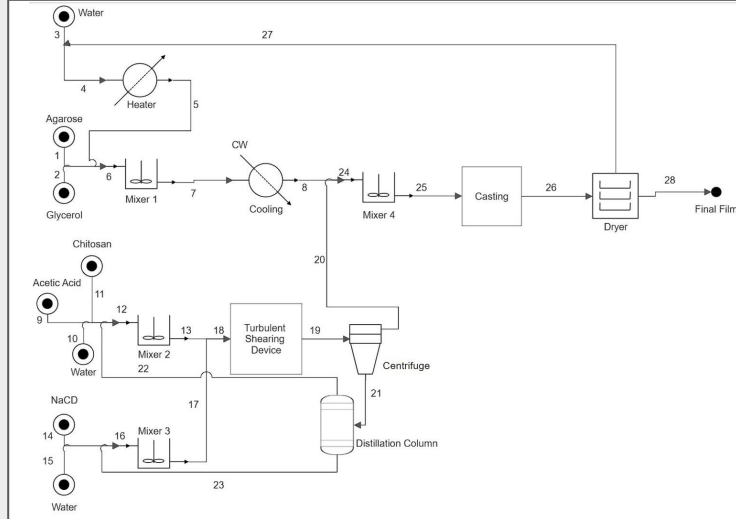
### 2. Background

- 450 million tons of plastic are made from petroleum-based biopolymers each year
  - 40% go into packaging, which is mostly PET
- Agarose and Chitosan are renewable and compostable resources with demonstrated physical strengths and film properties.
  - Agarose contributes the base of the film structure
  - Chitosan acts as a filler, adding structure to the network

### 3. Strength Properties

	SDC-Agarose Biopolymer	Polyethylene Terephthalate (PET)
Elongation at Break	12.5 %	125 %
Ultimate Tensile Strength	53 MPa	55 MPa
Water Contact Angle	95°	72.5°
Oxygen Permeability	$30 \frac{\text{cm}^3(\text{STP}) \cdot 100 \mu\text{m}}{\text{m}^2 \cdot \text{d} \cdot \text{bar}}$	$30 \frac{\text{cm}^3(\text{STP}) \cdot 100 \mu\text{m}}{\text{m}^2 \cdot \text{d} \cdot \text{bar}}$

### 4. Process Flow Diagram



### 5. Safety and Sustainability

#### Safety:

- Simple mechanical machinery and lack of chemical reactions means less extensive knowledge and safety trainings are required for operation.
  - Less likelihood for catastrophes and accidents.

#### Sustainability:

- Agarose and chitosan (as well as the other solvents) are all renewable and compostable.
- There are no toxic mediums or waste that could jeopardize the surrounding ecosystems.
  - No waste in general due to the incorporation of the recycle stream.

### 6. Economics and Profitability

	SDC-Agarose Biopolymer	PE	PP	PET	PS	PVC
Price per kg	\$9.34	\$1.21	\$1.21	\$0.95	\$1.59	\$1.39

- Compared with the average \$1.27/kg price of petroleum-based plastics, this new biopolymer will cost at least 635% more, depending on the market price assigned for profit.
- There is potential for minuscule cost reductions in tax rewards for green buildings and processes, and in government subsidy since this product would help the country meet a number of developmental goals.

### 7. Conclusion

- Due to its excessive production costs, the SDC-Agarose biopolymer composite film would have a hard time competing with the current petroleum-based plastics used in films today.
- Since it is not economically viable, it should remain as a case study and testament to the future of sustainable packaging, until cheaper resources can be acquired.

### 8. Acknowledgement

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