Key criteria:
Blood bags need to be **eco-friendly,** maintain a **high level of impermeability to gases and liquids** to prevent contamination, and ensure the integrity of the blood components. They also require materials that are **compatible with blood** and maintain **proper sterilization conditions**.

Components	***Compatibility***
<u>Areca palm leaves</u>	Pros: ● Sturdy and flexible ● Natural durability and water-resistant nature of the leaves make them ideal for holding liquids ● Some natural resistance to moisture due to their waxy surface ● Biodegradable, compostable, and do not require any chemical processing or treatment Concerns: ● Not completely impermeable – over time, liquids can gradually seep through the leaf structure, especially if they are stored for extended periods or exposed to too much moisture
<u>Polyethylene Terephthalate (PET) Biofilms</u> *According to research, PET is compatible with Areca (verify this in lab)	Pros: ● Good barrier properties, providing a certain level of impermeability to gases and liquids ● Resistance to moisture transmission Concerns: ● Needs to be extensively tested and engineered to ensure the safe storage and transport of blood and blood products
<u>Alpha chitin</u> ➔ Polysaccharide and structural component found in the exoskeletons of arthropods as well as in the cell walls of certain fungi	Pros: ● Highly organized and crystalline structure, which provides strength and rigidity to the structures it forms ● Mechanical properties: high tensile strength and toughness ● Biodegradable ● Isolated from natural sources, such as

➔ Biopolymer composed of long chains of N-acetylglucosamine (GlcNAc) units linked together	shrimp shells or fungal cell walls, and processed into various forms, including films, fibers, and particles ○ Used in development of bioplastics, wound dressings, drug delivery systems, and other biomedical applications ● Supports blood coagulation, platelet adhesion, and other important biological processes related to hemostasis (biocompatible) Concerns: ● Permeability characteristics and compatibility with blood components ● Standardization, regulatory approval, and scalability

Simplified Laboratory Process of Meshing our Biodegradable Blood Bag Components:

To mix Areca palm leaves, bioplastic films, and alpha-chitin together:

1. Areca Palm Leaves: The Areca palm leaves should be cleaned and processed to get rid of any impurities. Then, cut them into smaller pieces or shred them to facilitate mixing and ensure uniform distribution.
2. PET Biofilms: Depending on the required consistency and processing technique, either chop them up into smaller pieces or grind them into granules.
    a. OR use PET resin (comes for extrusion of PET films, similar to how PVC blood bags are created) and combine with areca leaves and chitin to produce a compound. Then, extrude this compound through a machine. Finally, put it through a die to flatten it out and create a plastic.
3. Alpha-Chitin: Take alpha-chitin from an appropriate source, such crustacean shells (make sure they are sterile and clean).
    a. Deproteinize the shells by soaking them for a few hours to overnight in an alkaline solution, such as potassium hydroxide (KOH) or sodium hydroxide (NaOH).
    b. Then, conduct demineralization (because we need to obtain pure chitin) by submerging the shells in an acid solution, such as hydrochloric acid (HCl) or acetic acid (CH_3COOH). The acid reacts with the minerals, dissolving them and leaving behind the chitin.
    c. To get rid of any contaminants, wash the chitin once more through the use of distilled water or a suitable solvent. The chitin may be extracted from the liquid via filtration (use filter paper, a mesh sieve, or a centrifuge).

4. Measurements/Proportions: Based on the desired qualities, determine the ideal ratio of each material in the composite. - needs extensive lab testing
5. Combine the alpha chitin fibers, PET bioplastic film granules, and shred Areca palm leaves in the specified ratios. Use a mechanical mixer to ensure uniform dispersion of the components.
6. If desired, additional additives like plasticizers, compatibilizers, or reinforcing agents can be incorporated to enhance the performance or specific properties of the composite.
    a. Can test in the lab.
    b. Here are some options:
        i. Plasticizers - citrate esters, succinate esters, tributyl citrate, epoxidized vegetable oils
            1. All are biodegradable and compatible with our 3 components
        ii. Stabilizers - moisture/oxygen compounds (PVOH, PLA, Cellulose, Chitosan), heat (PLA)
        iii. Compatibilizers - PLA
7. To process: To produce the required shape or structure, the composite mixture can be further treated using methods like compression molding, extrusion, or 3D printing.