



Molding & Casting

from a bio-based materials perspective

Fab Academy 2026
Alysia Garmulewicz
Pilar Bolumburu



Bio-based materials

Materiom AI and data sources

Materiom AI - Google's Gemini Models combined with 30 million OA papers and Materiom's user contributed formulations

An AI Assistant for bio-based materials research



Materiom AI is an AI tool designed to help you with bio-based materials discovery. It can provide fast, **directional guidance** on:

- Bio-based ingredients and additives, including common pairings
- Appropriate methods for processing formulations
- Performance and biodegradation potential of ingredients and ingredient combinations, and more...



Filters

Ingredients

- Carbohydrates/ Polysaccharides (89)
- Lipids / Fats / Waxes / Oils (86)
- Minerals and salts (9)
- Natural Composites (5)
- Proteins (28)
- Other (211)

Processes

- Bubbles removed (1)
- Casted (50)
- Cold Pressed (21)
- Cut (3)
- Dried (55)
- Extruded (9)
- Fermented (18)
- Fired (1)
- Foamed (2)
- Frozen (3)

Properties

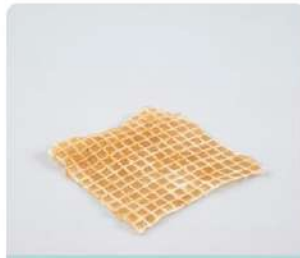
Choose property

Search

Graph Materials

Manage Materials (0)

Clear Materials



Jute-reinforced microbial ...



Cork | pine resin (low heat...



Home-made clays



Borago & Carrageenan Bi...



Red Cabbage | Bioplastic



Cork | pine resin (high he...



Eggshell paste for 3d prin...



Agar | Gelatin bioplastic ...





Spiber



DESSERTO



NOTPLA



Agraloop
BIOFIBRE™



KENRA



kelpi



SWAY



ecovative



GREAT WRAP



BIOMASON



evoware



evoware



SHELLWORKS



SHELLWORKS



SHELLWORKS

Molding & Casting Class

First Part (30 min)

- Introduction
- Mold types
- Materials for Molding & Casting

Second Part (30 min)

- Machining Molds
- Software
- Safety Management
- Group & Individual Assignment



Molding & Casting

Definitions

Molding

The Tool: Molding is the process of creating a negative cavity or tool (mold) that holds a reverse impression of an original model.



Casting

The Product: Casting is the process of pouring or injecting liquid/pliable material (resin, metal, plaster) into that mold, allowing it to solidify to create a positive, finished part.



Mold Types

By piece complexity



**One Piece
Mold**



**Two-Piece
Mold**

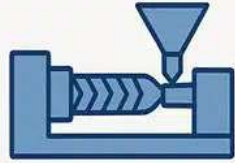


**Three or More
Piece Mold**

Mold Types

By fabrication method

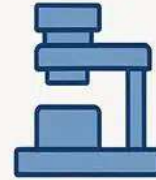
TYPES OF PLASTIC MOLDING



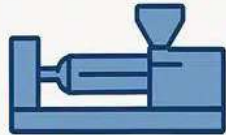
**INJECTION
MOLDING**



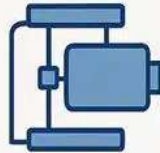
**BLOW
MOLDING**



**COMPRESSION
MOLDING**



**EXTRUSION
MOLDING**



**ROTATIONAL
MOLDING**



THERMOFORMING

Molding & Casting Materials

Key Concepts

- The material you cast informs the mold you make, and vice versa
- **Soft cast** → **rigid mold** (e.g. wax parts in plaster molds)
- **Rigid cast** → **flexible mold** (e.g. resin parts in latex or alginate molds)
- **Complex geometry / undercuts** → flexible mold always
- **Bio molds are often single- or short-use:** factor this into design
- **Consider shelf life:** alginate and gelatine molds degrade; plan your casting window



Why bio-based materials?

Definitions:
Biobased vs
Biodegradable



Integral Approach to
Materials Life Cycle and
Lower Toxicity



Biobased:
Feedstock and
sources variety



Production Process:
Role of Ingredients in
Material Composition
and Properties

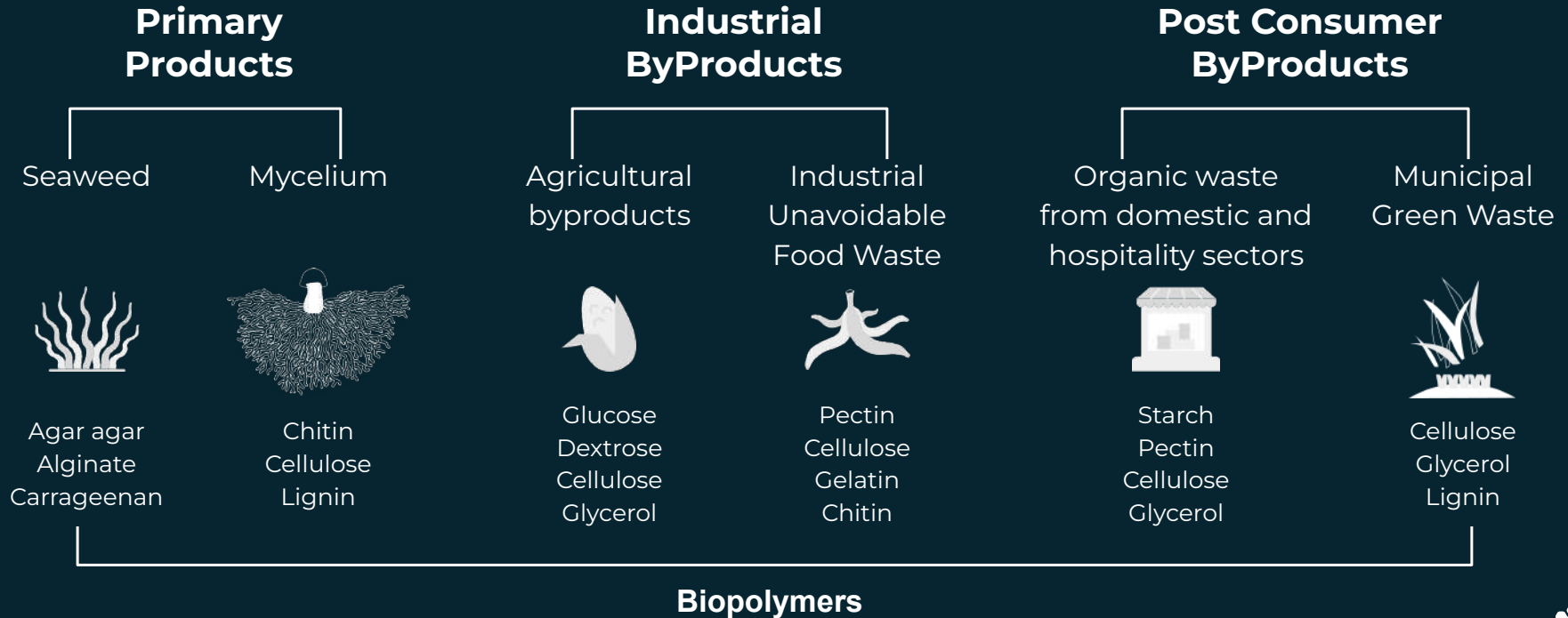


End-of-Life:
Biodegradability
Strategies and
Regenerative Approach



Feedstock & Sourcing

From local and abundant biomass



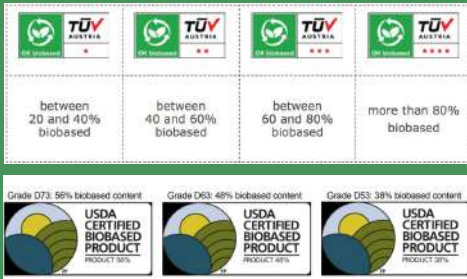
Biobased / Biodegradable

Bio-based

Derived wholly or partly from renewable biological sources such as plants, algae, or microorganisms.

Advantage: Potential reduction of fossil fuel dependency and associated greenhouse gas emissions.

Not necessarily biodegradable.



Biodegradable

Designed to break down through microbial activity into natural substances such as water, carbon dioxide, and biomass under specific environmental conditions.

Advantage: Capacity to reduce environmental persistence where recovery or recycling is impractical.

They can be derived from biological and/or fossil sources.



Wax

Machinable Wax



Carving
Modeling
Injecting
Extrusion
CNC/ 3DP

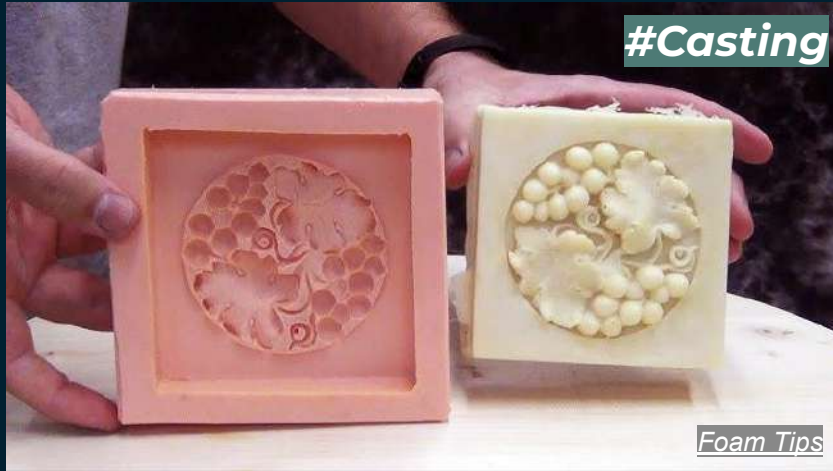


Natural Waxes



Foam

Rigid Foam



Two-parts mix (polyurethane)
From liquid to solid
Restricting rise increase density

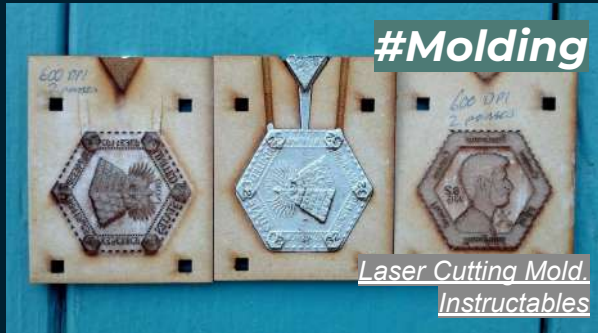
Biobased Foam



Review: [Other formulations of biobased foam for tangible interaction](#)

Wood & Lignocellulosic

Wood-derived Composites



Lignocellulosic composites
bonded with biopolymers

Mycelium

Lignocellulose-derived Composites



Lignocellulosic composites
bonded with mycelium

Rubber & Silicone



Biobased rubbery materials

Alginate Gel



Alginate mold to
casted plaster mask

Biobased rubbery materials

Natural rubber & liquid latex



Thermoplastic vs Thermoset Materials

Thermoplastics

Polymers that soften into a **liquid state when heated and solidify upon cooling**, allowing them to be remelted and reshaped multiple times. In molding, they are primarily used for high-volume injection processes where speed and material recyclability are critical.

E.g.: ABS (Acrylonitrile Butadiene Styrene), Nylon, Polyethylene, and Polypropylene.

Thermosets

Polymers undergo a **permanent chemical cross-linking during curing**, resulting in a rigid molecular structure that cannot be remelted or reformed once set. In casting, they are favored for their superior heat resistance and durability, though the material will burn or char rather than liquify if reheated.

E.g.: Epoxy resin, Silicone rubber, Polyurethane, and Polyester resin.

Biobased Thermoplastic Materials



Gelatin-based [Material Recipes](#).

Biobased Thermoplastic Materials



Mineral-based Materials



Biobased Mineral Materials



Metal



Glass



Molding & Casting Materials

Key Considerations

- **Viscosity:** does it flow into detail, or does it need pressure/vacuum assist?
- **Shrinkage & swelling:** affects fit, draft angles, and demolding
- **Exo/endothemic cure:** heat can damage mold (esp. wax or foam molds)
- **Moisture content:** relevant for plaster, alginate, starch; can cause mold degradation
- **Release behavior:** sticky materials (resins, waxes) need more attention to release agents
- **Fiber/filler content:** composites (mycelium, papercrete) may need degassing or vibration.



Thank you

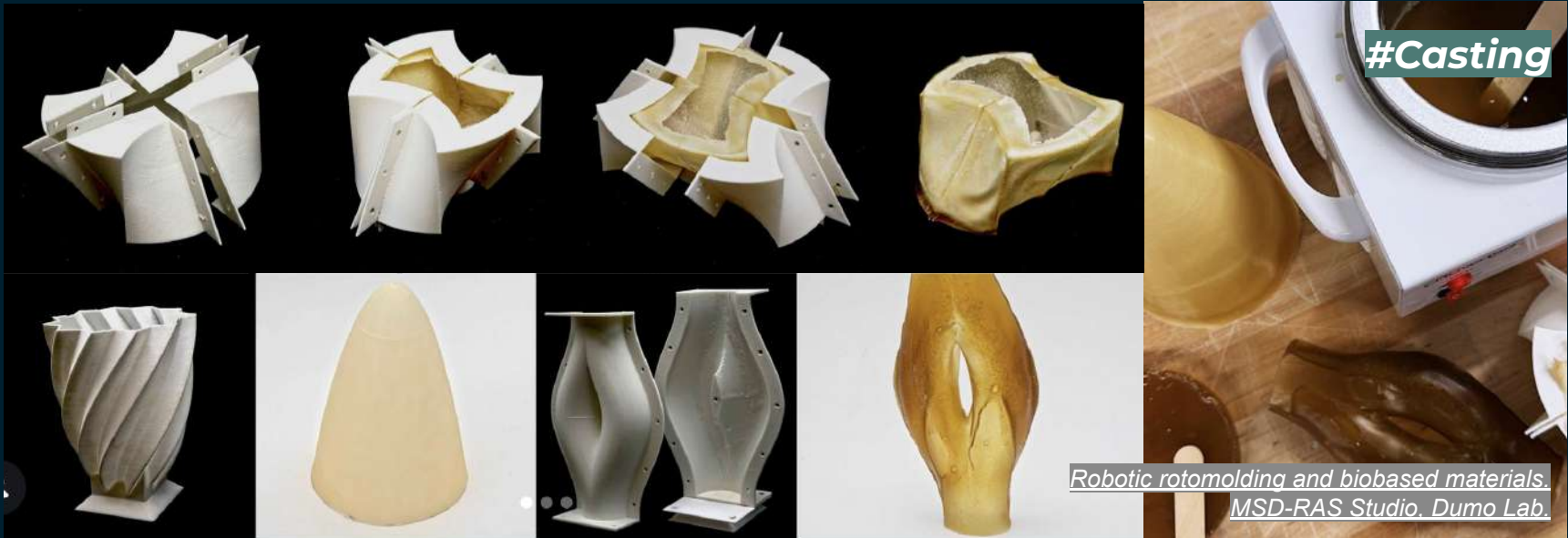
✉ alysia@materiom.org

✉ pilar@materiom.org

 materiom.org

 [@materiom_](https://www.instagram.com/materiom_)

Biobased Thermoplastic Materials



#Casting

*Robotic rotomolding and biobased materials.
MSD-RAS Studio, Dumo Lab.*