STEAM in Education

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THE USE OF PLANT MATERIAL IN OBTAINING BIOPLASTIC

Bioplastic materials, made from renewable sources like potato starch, corn, and vegetable oil, offer eco-friendly alternatives to traditional plastics. Starch, a key component in plants, serves as a vital building block for bioplastic production. With benefits like reduced ecological impact and suitability for packaging, bioplastics are a logical choice for replacing fossil-fuel based plastics.

Therefore, our objectives were focused on developing an environmentally sustainable option through the utilization of plant materials not fit for human consumption, production of starch-based materials and subsequent evaluation of the product for permeability, hardness, and biodegradability.

1. METHODS

1. Starch extraction

Fodder potato | Corn | Market potato

Starch

2. Bioplastic obtaiment process

Amylopectin + Acetic acid → Amylose

Glycerin

mixing on a steam bath

Bioplastic

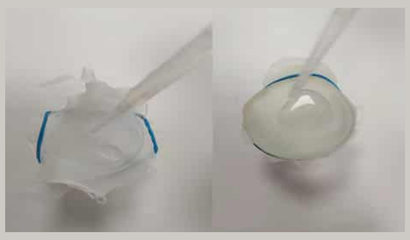
3. Mechanical properties

- Testing the *hardness* of foils: with an Shore C digital durometer

Shore C Digital Durometer

Potato film hardness (C1)

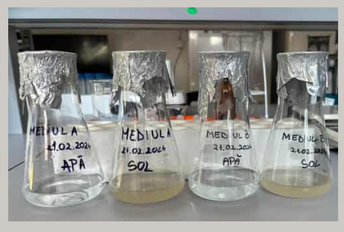
- Testing the permeability of foils

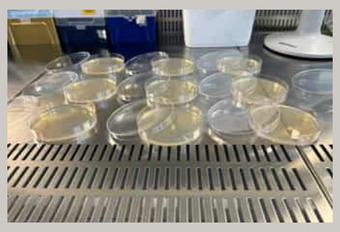


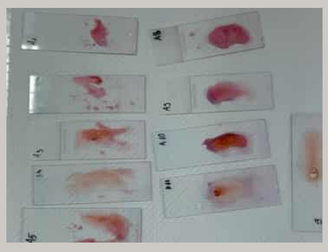
4. Biodegradability

Minimal Salt Medium

Solid and liquid media



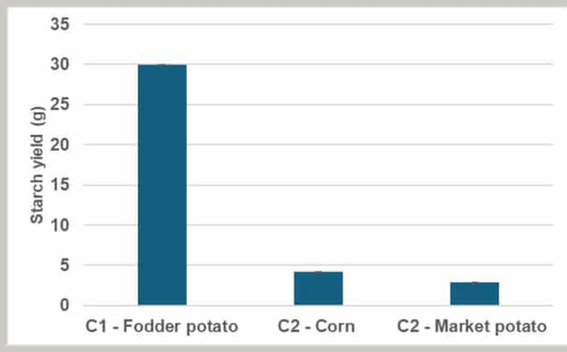




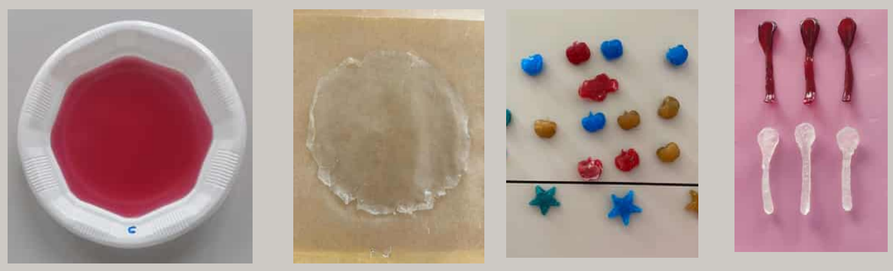
Strain identification

5. RESULTS

- The highest starch yield was obtained after extraction from C1 - Fodder potatoes.



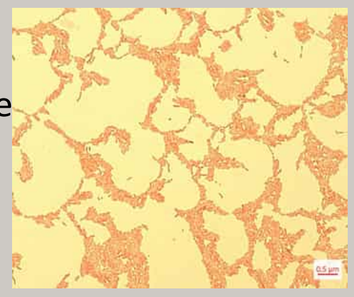
- Different objects were produced like foils, ornamental objects, and cutlery.



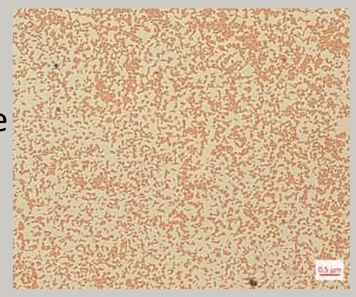
- The hardness of fodder potato-based starch material was 68,5 HRC compared to the corn-based starch foil which was 46,5 HRC.
- Microbial growth was observed after 48 hours of incubation in the Minimal Salt Medium supplemented with the fodder potato derived starch material and inoculated with soil and water sample.

- The Gram staining revealed that all the isolated strains were Gram negative, and rod shaped..

Gram-negative bacteria



Gram-negative bacteria



6. CONCLUSIONS

- We demonstrated that using fodder potato we can extract a larger amount of starch compared to the market potato.
- The resulting starch can be used for material fabrication with good hardness and impermeability.
- We proved that the material is biodegradable both in water and soil conditions.
- This study supports future research on alternatives for currently used petroleum-derived plastics.