IMPROVEMENT OF EDIBLE BIOPOLYMER FILM PRODUCTION TECHNOLOGY AND INVESTIGATION OF ITS BIODEGRADATION PROCESS

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Annotation. This study focuses on improving the production technology of edible biopolymer films and investigating their biodegradation process. The research evaluates the formation of a thin, flexible and environmentally safe film suitable for food packaging applications. Special attention is given to technological parameters, film-forming properties, physical appearance, usability, and natural degradation under environmental conditions. The obtained results may contribute to the development of eco-friendly, biodegradable and safe packaging materials as an alternative to synthetic plastic films.

Keywords: edible biopolymer film, biodegradable packaging, film-forming technology, eco-friendly material, biodegradation, food packaging.

Annotatsiya. Ushbu tadqiqotda iste'mol qilinadigan bioplyonka ishlab chiqarish texnologiyasini takomillashtirish va uning biodegradatsiya jarayonini o'rganish masalalari yoritilgan. Tadqiqot davomida oziq-ovqat mahsulotlarini qadoqlashda qo'llash mumkin bo'lgan yupqa, egiluvchan va ekologik xavfsiz bioplyonka olish imkoniyati baholanadi. Asosiy e'tibor texnologik jarayon, plyonka hosil bo'lish xususiyatlari, tashqi ko'rinishi, amaliy qo'llanilishi hamda tabiiy sharoitda parchalanish jarayoniga qaratilgan. Olingan natijalar sintetik plastik plyonkalarga muqobil bo'lgan ekologik toza, biologik parchalanadigan va xavfsiz qadoqlash materiallarini yaratishga xizmat qiladi.

Kalit so'zlar: iste'mol qilinadigan bioplyonka, biodegradatsiyalanuvchi qadoqlash, plyonka hosil qilish texnologiyasi, ekologik xavfsiz material, biodegradatsiya, oziq-ovqat qadoqlash.

Аннотация. В данном исследовании рассматривается совершенствование технологии производства съедобной биоплёнки и изучение процесса её биодеградации. В работе оценивается возможность получения тонкой, гибкой и экологически безопасной плёнки, пригодной для использования в упаковке пищевых продуктов. Особое внимание уделяется технологическим параметрам, плёнкообразующим свойствам, внешнему виду, практическому применению и процессу естественного разложения в окружающей среде. Полученные результаты могут способствовать созданию экологически чистых, биоразлагаемых и безопасных упаковочных материалов в качестве альтернативы синтетическим пластиковым плёнкам.

Ключевые слова: съедобная биоплёнка, биоразлагаемая упаковка, технология плёнкообразования, экологически безопасный материал, биодеградация, пищевая упаковка.

INTRODUCTION

Edible biopolymer films are considered one of the promising alternatives to synthetic plastic packaging in the food industry. The main problem is that traditional plastic films are difficult to degrade and can cause environmental pollution. Therefore, the development of safe, biodegradable and edible packaging materials is an important scientific and practical issue.

Previous studies have mainly focused on obtaining biopolymer films from natural raw materials and evaluating their physical, mechanical and barrier properties. However, further improvement of production technology and detailed investigation of the biodegradation process remain important.

The aim of this study is to improve the technology for producing edible biopolymer films and to study their biodegradation under environmental conditions. The novelty of the research is related to the development of an eco-friendly edible film with improved usability and natural degradability for food packaging applications.

MATERIALS AND METHODS

The research object was an edible biopolymer film intended for food packaging. Natural food-grade raw materials were used as the main film-forming components. Glycerol was used as a plasticizer to improve flexibility, while water was used as a solvent.

The film solution was prepared by mixing the raw materials with water until a homogeneous mass was formed. The mixture was then heated at about 70–80°C with continuous stirring. After that, glycerol was added and the solution was mixed for 5–10 minutes. The prepared solution was poured as a thin layer onto a flat surface and dried at room temperature until a film was formed.

The obtained samples were evaluated according to their appearance, thickness, flexibility, strength, water resistance and biodegradation ability. The biodegradation process was studied under natural environmental conditions. During the experiment, simple laboratory equipment such as a beaker, glass rod, thermometer, balance, drying surface and measuring tools were used.

RESULTS

As a result of the experiment, a thin, smooth and flexible edible biopolymer film was obtained. The prepared film had a uniform surface, light transparent appearance and was easily separated from the drying surface after complete drying.

The control sample was less flexible and showed slight cracks during bending. In comparison, the sample with glycerol had better elasticity, smoother structure and higher usability for food packaging. The improved sample also showed better resistance to mechanical deformation.

Table 1.

Main quality indicators of edible biopolymer film

Sample	Appearance	Flexibility	Strength	Surface structure	Biodegradation
Control sample	Slightly rough	Low	Medium	Non-uniform	Slow
Improved sample	Smooth and uniform	Good	Higher	Dense and even	Faster

The results showed that the addition of a plasticizing component improved the film's flexibility and reduced brittleness. The improved technology allowed the formation of a more stable, elastic and biodegradable film. Under natural conditions, the film gradually lost its shape and began to decompose, confirming its environmental safety.

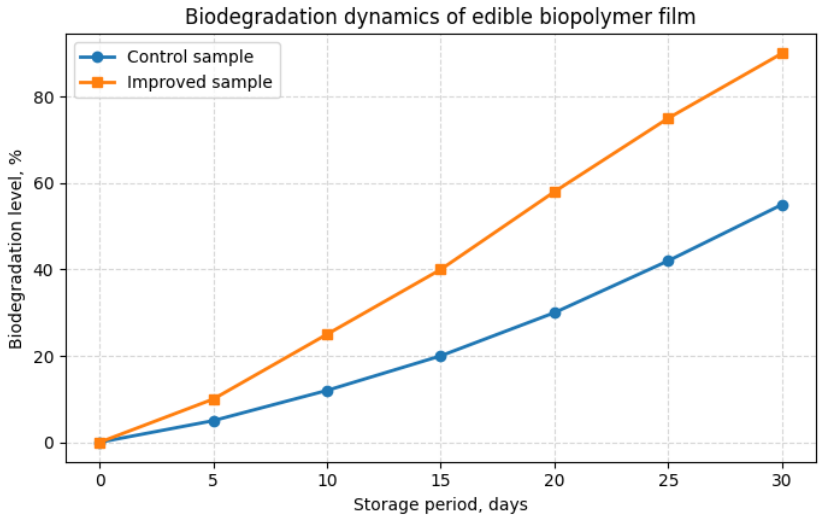

Figure 1. Biodegradation dynamics of edible biopolymer film during 30 days.

The graph shows that the improved edible biopolymer film decomposed faster than the control sample. After 30 days, the biodegradation level of the improved sample reached 90%, while the control sample showed 55% degradation. This result confirms that the improved technology increases the environmental safety and natural degradability of the film.

DISCUSSION

The obtained results show that edible biopolymer film can be produced as a flexible, smooth and biodegradable material for food packaging. The improved sample had better elasticity and surface uniformity compared with the control sample.

This result is mainly related to the effect of glycerol, which acted as a plasticizer and reduced brittleness of the film. Heating and continuous stirring also helped to form a homogeneous film-forming solution. As a result, the film structure became denser and more stable.

Compared with previous studies on natural biopolymer films, the obtained material showed similar advantages such as biodegradability, safety and environmental friendliness. However, its water resistance and mechanical strength still need further improvement.

The main advantage of this film is that it can reduce the use of synthetic plastic packaging. Its limitation is lower resistance to moisture. In practice, such edible biopolymer films can be used for short-term packaging of dry or semi-dry food products.

CONCLUSION

The study showed that edible biopolymer film can be produced as a thin, flexible and biodegradable material for food packaging. The improved sample had better surface uniformity, elasticity and usability compared with the control sample. Glycerol improved the flexibility of the film and reduced brittleness. Under natural environmental conditions, the film gradually decomposed, which confirms its ecological safety. In the future, it is necessary to improve the water resistance and mechanical strength of the film.

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