# DISPOSABLE ECOLOGICAL CONTAINERS FROM CANE BIOMASS AND THEIR DECOMPOSITION PROPERTIES

# QAMISH BIOMASSASIDAN OLINGAN BIR MARTALIK EKOLOGIK IDISHLAR VA ULARNING PARCHALANISH XOSSALARI

# ОДНОРАЗОВЫЕ ЭКОЛОГИЧЕСКИЕ КОНТЕЙНЕРЫ ИЗ ТРОСТНИКОВОЙ БИОМАССЫ И СВОЙСТВА ИХ РАЗЛОЖЕНИЯ

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**Annotatsiya**. Ushbu maqola qamish biomassasidan ishlab chiqarilgan bir martalik ekologik idishlarning parchalanish xossalarini tahlil qilish va ularning atrof-muhit uchun qulayligini baholashga bag'ishlangan. Maqolada zamonaviy adabiyotlar tahlili orqali qamish biomassasining xususiyatlari, ishlab chiqarish texnologiyalari va parchalanish jarayonlari o'rganilgan. Natijalar shuni ko'rsatadiki, qamish asosidagi idishlar an'anaviy plastik idishlarga nisbatan muhim ekologik ustunliklarga ega bo'lib, 90-180 kun ichida to'liq parchalanish qobiliyatiga ega. Tadqiqot xulosalari qamish biomassasining barqaror rivojlanish maqsadlari doirasida perspektivali alternativ bo'lishini tasdiqlaydi.
**Kalit so'zlar:** qamish biomassasi, biodegradatsiya, ekologik idishlar, barqaror rivojlanish, atrof-muhit muhofazasi
**Abstract.** This article is devoted to the analysis of the decomposition properties of disposable ecological containers produced from cane biomass and the assessment of their environmental friendliness. The article explores the properties of cane biomass, manufacturing technologies, and degradation processes through analysis of modern literature. The results show that Reed-based containers have significant environmental advantages over traditional plastic containers, with the ability to fully decompose in 90-180 days. The research conclusions confirm that Cane biomass is a promising alternative within sustainable development goals.
**Keywords:** cane biomass, biodegradation, ecological containers, Sustainable Development, Environmental Protection
**Аннотация.** Эта статья посвящена анализу разложительных свойств одноразовых экологических контейнеров, изготовленных из тростниковой биомассы, и оценке их экологичности. В статье изучены особенности биомассы тростника, технологии производства и процессы разложения посредством анализа современной литературы. Результаты показывают, что контейнеры на основе тростника обладают значительными экологическими преимуществами по сравнению с традиционными пластиковыми контейнерами, способными полностью разлагаться в течение 90-180

дней. Результаты исследования подтверждают, что биомасса тростника является многообещающей альтернативой в рамках Целей устойчивого развития.

**Ключевые слова:** тростниковая биомасса, биоразложение, экологические контейнеры, устойчивое развитие, защита окружающей среды



## INTRODUCTION

In the modern world, the problem of plastic waste is considered one of the main causes of the global ecological crisis. Every year, 300 million tons of plastic waste are generated worldwide, of which only 9% is recycled [1]. This situation poses a serious threat to the environment and human health. In this regard, the issue of producing disposable containers from biodegradable materials is becoming increasingly urgent.

Among biodegradable materials obtained from plant biomass, reed holds a special place. Phragmites australis (common reed) is widely distributed in many regions of the world and has rapid growth and high biomass productivity [2]. Reed contains cellulose (40-45%), hemicellulose (25-30%), and lignin (20-25%), making it an ideal raw material for producing biodegradable materials [3].

The technology for producing disposable containers from reed biomass is a relatively new direction that attracts attention as an environmentally safe alternative to traditional plastic containers. The aim of this research is to conduct an in-depth analysis of the decomposition properties of disposable containers obtained from reed biomass and to assess their environmental friendliness.

## METHODOLOGY AND LITERATURE REVIEW

This research is based on systematic literature review methodology. According to the results of the literature review, the chemical composition of reed biomass determines its biodegradation capability. Research conducted by Zhang and colleagues (2019) determined that the cellulose content of reed fiber varies between 42-46% [4]. Cellulose is easily decomposed by microorganisms, which helps reed-based materials biodegrade quickly.

The technology for producing containers from reed biomass consists of several stages. First, reed biomass is crushed and chemically treated. Then it is pressed into shape and dried. In the methodology developed by Petrov and Sidorov (2020), reed biomass is treated with a 5-10% carbonic acid solution, which reduces lignin content and improves material quality [5].

The biodegradation process depends on several factors. Temperature, humidity, pH level, and the presence of microorganisms affect the decomposition rate. Research conducted by Kumar and others (2021) showed that reed-based materials completely decompose within 120-180 days under normal conditions [6]. In compost conditions, this process is reduced to 60-90 days.

Reed biomass has advantages over other plant materials. First, reed grows quickly and has high annual productivity. Second, it can grow in saline and moist soils, which does

not compete with agricultural land. Third, reed is effective in absorbing CO2, positively affecting the carbon cycle [7].

**RESULTS AND DISCUSSION**

Summarizing the results of the literature review, the following characteristics of disposable containers obtained from reed biomass were identified:

Analysis of biodegradation rate shows that reed-based containers decompose at different rates under various environmental conditions. Decomposition occurs faster under aerobic conditions (in the presence of oxygen). Research conducted by Tong and colleagues (2022) determined that 85-95% decomposition of reed-based materials occurs within 90 days under aerobic conditions [8]. Under anaerobic conditions, this process lasts 150-200 days.

Analysis of decomposition products provides important ecological information. Reed biomass mainly produces carbon dioxide, water, and organic compounds during the decomposition process. These products do not harm the environment and even have soil enrichment properties. Research conducted by Rodriguez and others (2023) determined that decomposition products of reed-based materials improve soil quality by 15-20% [9].

In terms of physical-chemical properties, reed-based containers have sufficient strength and functionality. They can withstand temperatures up to 60-80°C and are suitable for liquids. However, they may become slightly soft under water influence during long-term storage. This characteristic may be a limiting factor for some applications.

Economically, the production costs of reed-based containers are currently 20-30% higher than traditional plastic containers. However, considering ecological benefits and waste disposal costs, they may be economically beneficial in the long term. Economic analysis conducted by Ivanov and Petrov (2023) predicted that reed-based materials will be competitive in a 5-7 year perspective [10].

There is a need to improve the technological process of producing containers from reed biomass. Current technologies require energy and use some chemical reagents. Developing more environmentally clean and energy-efficient methods in the future is an important task.

Comparative analysis of containers obtained from reed biomass with other natural materials provides important information. Table 1 presents the main indicators of various biodegradable materials.

**Table 1.1**

**Comparative analysis of various biodegradable materials**

| Material | Biodegradation period (days) | Strength (MPa) | Production cost (USD/kg) | Water resistance (hours) |
|---|---|---|---|---|
| Reed biomass | 90-180 | 25-35 | 2.8-3.2 | 4-6 |
| Corn starch | 60-120 | 15-25 | 3.5-4.0 | 2-3 |

| | | | | |
|---|---|---|---|---|
| Wheat residues | 120-200 | 20-30 | 2.5-3.0 | 3-4 |
| Paper pulp | 30-90 | 10-20 | 1.8-2.2 | 1-2 |
| PLA plastic | 180-360 | 40-60 | 3.0-4.5 | 24+ |

Table analysis shows that reed biomass has an optimal combination of characteristics compared to other natural materials. In terms of biodegradation period, reed has average indicators, which is considered suitable for practical application. Very quickly decomposing materials can cause problems during storage and transportation, while very slowly decomposing materials do not fully meet ecological objectives.

In terms of strength parameters, reed-based materials are sufficiently strong, meeting the necessary requirements for most disposable containers. These materials can be used for hot food and liquids, significantly expanding their application area. The water resistance indicator of 4-6 hours is sufficient for typical eating processes, while preventing unnecessary waste formation during excessively long storage.

Economically, reed-based materials fall into the medium price category. Although they are more expensive than paper pulp, they are cheaper than PLA plastic and competitively priced compared to corn starch. In the future, increased production volumes and technology improvement are expected to further reduce prices. Additionally, reed being a local raw material reduces transportation costs and eliminates the need for imports, which increases overall economic efficiency.

**CONCLUSION**

Disposable ecological containers obtained from reed biomass can be one of the solutions to the modern plastic waste problem. Research results show that reed-based materials have the ability to completely biodegrade within 90-180 days and produce environmentally safe decomposition products. Reed's high productivity, rapid growth characteristics, and non-competition with agriculture make it a sustainable raw material source.

However, solving several problems is necessary for widespread application of reed-based containers. Improving production technology, reducing costs, and enhancing some technical characteristics of the material are important tasks. There is also a need to raise ecological awareness among consumers and implement government incentive measures.

For future development of the reed biomass container market, it is recommended to continue scientific research, optimize production technologies, and work on improving economic efficiency. These can be important steps in achieving sustainable development goals and protecting the environment.

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