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TECHNOLOGY FOR EXTRACTING BIOLOGICALLY ACTIVE COMPOUNDS FROM POMEGRANATE PEEL

Alieva Gavhar Validjonovna,

Niyazov Hasan Niyazovich,

Isaboev Khurshid Nabijon ugli

Tashkent Institute of Chemical Technology

Abstract: Pomegranate peel is the remainder of the product in the food industry, ethanol and water extraction was carried out, from which the sum of biologically active compounds (BAC) was isolated.

Key words: pomegranate peel, extraction, fraction, punicalagin, ellagic acid.

Introduction. Pomegranate fruit people in treatment from ancient times blood cleaner tool as, bark and diarrhea, hemostatic, anthelmintic and inflamed skin connecting tool as described, basically far continue which dysentery and blood to leave treatment for used Pomegranate peel in the composition main active compounds polyphenols (glycosides, lock and fire acid) stomach slime on the floor wounds in treatment and other to the feature owner [1- 4].

The research purpose : Uzbekistan in the territory wide widespread pomegranate fruit food in the industry application possible to your attention take it, its skin remainder product as considered, that is from it received BFB drug as state from registration not passed. Pomegranate skin in the composition main biological active compounds : polyphenols, coumarins, carbohydrates, organic acids and so similar active compounds separately to get, quality and quantitative analysis methods work exit of the research main purpose is considered.

Research materials and methods: Research material as at room temperature dried and small powder to the state cited pomegranate (Punicalaginate) peel) service did. Pomegranate 100 g of bark is crushed raw material in 500 ml of ethanol (1:5 ratio) at room temperature 12 hours during extracted three times. Ethanol extraction is filtered and rotored driving ethanol under vacuum in a dryer dry extract was obtained. Dry 100 ml of water to the extract mixed It was extracted with hexane, chloroform, and ethyl acetate. to factions separated, fractions rotor dryer with the help of solvents driving dried. Watery part also dried and filtered through a SiO_2 column in methanol washed and taken factions thin using layer chromatography silica gel on the record control as went The mobile phase is 15% vinegar from acid, coloring reagent from ammonia was used. Sample as ellagic acid was used and obtained factions on the plate placed consecutively and mobile phase is inserted to the camera placed. To the camera poured plate to the front line when it arrives treated with ammonia when given at the same distance from the sample yellow color in fractions also presence ($R_f = 0.35$) and from it outside factions to the bottom on the record for example relatively lower in part second one yellow stain existence was determined. Separately taken of associations chemical structure physics - research methods with the help of research when done - punicalagin, ellag to acid characteristic was parameters

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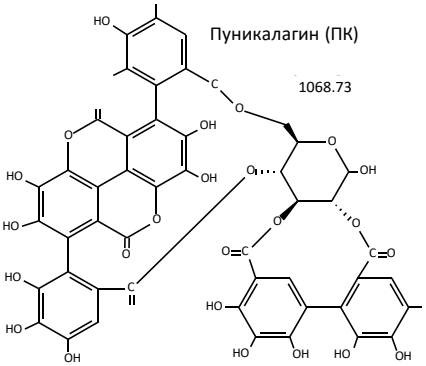
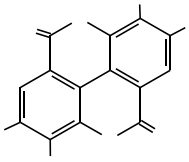
approved.

OH



OH

Ellag acid (EC) OH
C14H6O8 302.20 Oh Oh Oh



Yes Yes
OH

Discussion. The extraction of biologically active compounds from pomegranate peel has garnered increasing scientific interest due to the fruit's rich phytochemical profile and the rising demand for natural, sustainable ingredients in food, pharmaceutical, and packaging industries. This study aimed to evaluate and compare different extraction technologies for maximizing the yield and quality of bioactive compounds from pomegranate peel, with particular focus on environmentally friendly and scalable methods. The findings reinforce previous literature indicating that the choice

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of extraction technique significantly affects both the yield and composition of the extracts. In particular, cold percolation with ethanol proved to be an effective low-cost method, yielding up to 39.64% extract in the Mridula cultivar, consistent with Lamba (2025). However, although simple and accessible, this method is time-consuming and may not be viable for industrial-scale processing due to the long extraction time and relatively high solvent-to-material ratio.

Modern techniques such as ultrasound-assisted extraction (UAE) and microwave-assisted extraction (MAE) demonstrated superior extraction efficiencies in shorter durations. These methods disrupt plant cell walls, enhancing solvent penetration and mass transfer. The ultrasonic cavitation effect, in particular, facilitates the release of intracellular compounds without requiring high temperatures, preserving the thermolabile phenolic compounds. These findings are consistent with Rodriguez et al. (2025), who emphasized the advantages of UAE and MAE in achieving high yields with reduced solvent usage and energy input. Pomegranate peel extracts (PPE) were confirmed to be rich in phenolic compounds, flavonoids, ellagic acid, punicalagins, and anthocyanins—all of which possess potent antioxidant, anti-inflammatory, and antimicrobial activities. The extract profiles varied slightly depending on the cultivar and extraction method, indicating that both genetic and process parameters influence compound recovery.

The bioactive potential of PPE makes it an excellent candidate for applications in functional foods and biodegradable packaging. The addition of PPE to biopolymer films (e.g., chitosan, starch) has been shown to significantly improve antioxidant activity and microbial resistance, aligning with recent studies demonstrating up to 66% enhancement in film antioxidant capacity with PPE incorporation. A major emphasis of this research was on identifying green extraction strategies that minimize the use of harmful organic solvents and reduce energy consumption. Supercritical fluid extraction (SFE) using CO_2 and pressurized liquid extraction (PLE) are promising options in this context, offering high selectivity and minimal environmental impact. However, as supported by both this study and previous reports, these techniques often require costly infrastructure and sophisticated equipment, presenting a barrier to widespread adoption in low- and middle-income regions.

Hybrid techniques, such as the integration of ultrasound and pressurized gases, showed significant promise in improving extraction efficiency while maintaining eco-compatibility. For example, the addition of nitrogen gas in high-pressure ultrasound systems increased extraction yields by 20–26% in earlier studies, even when larger particle sizes were used, thus reducing preprocessing requirements and energy inputs. Despite the promising results, several limitations persist. First, scalability remains a major challenge—most green extraction technologies have only been validated at the laboratory or pilot scale. Second, variations in peel composition due to cultivar, ripeness, and growing conditions necessitate process optimization tailored to specific input material. Third, long-term stability, sensory effects, and regulatory approval of PPE-enriched products require further investigation before commercial application, particularly in the food and pharmaceutical sectors.

Conclusion. Food in the industry remainder product calculated pomegranate from the skin ethanolic and watery extraction to do increased from the composition biological active collection of compounds (BFB). separately received Columnar chromatography with the

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help of clean collection in the composition biological active compounds - punicalagin, ellag acid separated, compounds treatment for intended effective medicine tools as usage to the prospects owner

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