

**PP15.4. TRANSFORMACIJA BILJNOG OTPADA U FARMACEUTSKE RESURSE:
MOGUĆNOSTI ZA ODRŽIVI RAZVOJ**

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Poljoprivredna proizvodnja i prerada hrane generišu ogromne količine biljnog otpada, što dovodi do ekonomskih gubitaka i značajnih ekoloških posledica. Međutim, ovi biljni ostaci predstavljaju bogate i nedovoljno iskorišćene izvore bioaktivnih jedinjenja i tehnološki vrednih sastojaka. U najistraživanije biljne sporedne proizvode spadaju komina i seme grožđa, spoljašnji delovi plodova citrusa i nara, komine bobičastog voća, listovi i komina masline, kao i ostaci žitarica. Ovi materijali sadrže raznovrsna vredna jedinjenja, uključujući polifenole (fenolkarboksilne kiseline, flavonoide, tanine i antocijane), karotenoide, polisaharide, proteine, fitosterole i vitamine. Takođe, mogu predstavljati izvore farmaceutskih pomoćnih supstanci, posebno celuloze i pektina. Brojna istraživanja su pokazala da jedinjenja dobijena iz biljnih nusproizvoda ispoljavaju antioksidantne, antimikrobne, antiinflamatorne, kardiometaboličke i antiproliferativne efekte, zbog čega imaju značajan potencijal za razvoj biljnih lekovitih proizvoda i dodataka ishrani. Nedavni napredak u tehnologijama ekstrakcije, naročito ekstrakciji potpomognutoj ultrazvukom i mikrotalasima, kao i ekstrakciji superkritičnim fluidima, učinio je dobijanje bioaktivnih jedinjenja efikasnijim i održivijim, time što je omogućio veće prinose ekstrakcije, kraće vreme ekstrakcije, manju potrošnju rastvarača i bolje očuvanje termolabilnih sastojaka. Ipak, i dalje su prisutni značajni izazovi, posebno u pogledu standardizacije agroindustrijskih nusproizvoda za farmaceutsku primenu i kontrole kontaminata poreklom iz poljoprivredne proizvodnje. Stoga biljni otpad više ne bi trebalo posmatrati kao ekološki i ekonomski izazov, već kao obnovljiv i strateški važan resurs za razvoj održivih farmaceutskih proizvoda.

Zahvalnica

Rad je podržan od strane Fonda za nauku Republike Srbije (br. projekta 17574, BLACKCEUTICALS) i Ministarstva nauke, tehnološkog razvoja i inovacija Republike Srbije (br. 451-03-33/2026-03/200161 i 451-03-34/2026-03/200161).

**PP15.4. TRANSFORMATION OF PLANT WASTE INTO PHARMACEUTICAL RESOURCES:
OPPORTUNITIES FOR SUSTAINABLE DEVELOPMENT**

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Agricultural production and food processing generate enormous quantities of plant waste, leading to economic losses and considerable environmental burden. However, these discarded materials represent abundant and underutilized sources of bioactive compounds and technologically valuable constituents. Among the most extensively investigated plant by-products are grape pomace and seeds, citrus and pomegranate peels, berry pomaces, olive leaves and pomace, as well as cereal residues. These materials contain a wide range of valuable compounds, including polyphenols (phenolic acids, flavonoids, tannins, and anthocyanins), carotenoids, polysaccharides, proteins, phytosterols, and vitamins. They may also serve as sources of pharmaceutical excipients, particularly cellulose and pectin. Numerous studies have demonstrated that compounds recovered from plant by-products exert antioxidant, antimicrobial, anti-inflammatory, cardiometabolic, and antiproliferative effects, making them promising candidates for the development of herbal medicinal products and dietary supplements. Recent advances in extraction technologies, particularly ultrasound-assisted, microwave-assisted, and supercritical fluid extraction, have made the recovery of bioactive compounds more efficient and sustainable by providing higher extraction yields, shorter extraction times, lower solvent consumption, and improved preservation of thermolabile constituents. Nevertheless, major challenges remain, particularly the standardization of agro-industrial by-products for pharmaceutical applications and the control of agricultural contaminants. Plant waste should therefore no longer be regarded as a burden, but rather as a renewable and strategically important resource for the development of sustainable pharmaceutical products.

Acknowledgement

Supported by the Science Fund of the Republic of Serbia (#GRANT 17574, BLACKCEUTICALS) and the Ministry of Science, Technological Development and Innovation (Nos. 451-03-33/2026-03/200161 and 451-03-34/2026-03/200161).