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ODRŽIVOST KROZ DIZAJN – NOVA PARADIGMA U UPRAVLJANJU ŽIVOTNIM CIKLUSOM LEKA

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Koncept održivog razvoja zasniva se na principu da "se potrebe sadašnjeg društva zadovolje bez ugrožavanja mogućnosti budućih generacija da ostvare svoje potrebe" [1]. Ostvarivanje ovog principa zahteva promenu načina razmišljanja i postupanja, kako na ličnom, tako i na profesionalnom planu. Od istraživača u svim oblastima nauke očekuje se integracija principa održivosti u naučni i stručni rad, proučavanje tema povezanih sa održivim razvojem i formulisanje rešenja usmerenih ka prevazilaženju izazova u postizanju održivosti [2, 3].

Paradigma "Održivost kroz dizajn" u farmaceutskim naukama podrazumeva integraciju principa održivog razvoja u sve faze životnog ciklusa leka. U ovom radu razmatrane su ključne dimenzije koncepta "Održivost kroz dizajn" u različitim fazama životnog ciklusa leka, odgovarajući alati i aktivnosti:

- **Istraživanje i razvoj** zasnovani na: (i) prediktivnom modelovanju efikasnosti i bezbednosti, (ii) primeni principa zelene hemije, (iii) dizajnu proizvoda usmerenom na pacijenta, (iv) ranu procenu uticaja na životnu sredinu.
- **Proizvodnja i distribucija** sa minimizovanim uticajem na životnu sredinu kroz: (i) upotrebu obnovljivih resursa i smanjenje otpada, (ii) primenu biorazgradivih aktivnih farmaceutskih supstanci i ekscipijenasa, kao i reciklabilnih materijala za pakovanje, (iii) digitalizaciju procesa.
- **Klinička primena** koja podrazumeva: (i) racionalno propisivanje lekova, (ii) precizno doziranje, (iii) unapređenje adherence i (iv) integraciju digitalnih alata, što omogućava optimizaciju terapije i poboljšanje zdravstvenih ishoda uz izbegavanje prekomerne upotrebe lekova, kao i smanjenje otpada.

Paradigma "Održivost kroz dizajn" u farmaceutskim naukama predstavlja savremen, interdisciplinarni koncept koji prevazilazi okvire laboratorijskih istraživanja i tradicionalnih proizvodnih procesa, sa ciljem da se inovacije usklade sa širim prioritetima očuvanja životne sredine, farmakoekonomske efikasnosti i unapređenih zdravstvenih ishoda pacijenata.

Literatura

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SUSTAINABILITY BY DESIGN – A NEW PARADIGM FOR DRUG PRODUCT LIFE-CYCLE MANAGEMENT

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The essential principle of sustainable development is to "meet the needs of the present without compromising the ability of future generations to meet their own needs" [1]. In order to achieve this, a paradigm shift is necessary in the way we think and act as citizens and professionals. Scientists in different disciplines are expected to integrate sustainability principles in their work, investigate topics associated with sustainable development and provide solutions for sustainability challenges [2, 3].

The Sustainability by Design (SbD) in pharmaceutical sciences emphasizes the integration of sustainability principles across the entire drug product life cycle. In this work, key dimensions of SbD in different stages of pharmaceutical product life cycle, relevant tools and points of action are reviewed:

- **Research and development** based on: (i) predictive modelling of pharmaceutical safety and efficacy, (ii) green chemistry principles, (iii) patient-centric product design, and (iv) early environmental impact assessment.
- **Manufacturing and distribution** incorporating the principles of ecological footprint minimization through employment of: (i) renewable resources and waste minimization, (ii) biodegradable, recyclable active pharmaceutical ingredients, excipients and packaging materials, and (iii) process digitalization.
- **Clinical use** guided by: (i) rational prescribing; (ii) precision dosing, (iii) enhanced adherence, and (iv) incorporation of digital health tools, leading to therapy optimisation and improved health outcomes, while avoiding pharmaceuticals overuse and reducing waste.

SbD paradigm in pharmaceutical sciences is an advanced, interdisciplinary concept which extends beyond the laboratory benchtop and manufacturing site to align pharmaceutical innovation with the broader objectives of environmental stewardship, pharmacoeconomic efficiency, and improved patient health outcomes.

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