International Journal of Engineering Inventions
e-ISSN: 2278-7461, p-ISSN: 2319-6491
Volume 15, Issue 3 [March 2026] PP: 139-141

Mangosteen waste valorization – some current highlights: an overview

Vanya Zhivkova[1*]
[1]*University of Economics – Varna, blvd "Knyaz Boris I" 77, 9002 Varna, Bulgaria*

Abstract. *The presentation in a summarized and systematized form of main highlights of the possibilities for effective valorization of mangosteen waste as an element of the management of this waste was the main purpose of the current overview paper. Some recent research trends in the mangosteen waste utilization were derived, applying a descriptive approach, based on a literature survey conducted among several scientific databases using keywords "mangosteen waste". Outside the scope of this work remained book chapters. Scientific publications were included here, with the help of which the aim was to outline the basic framework of some main tendencies in the mangosteen waste valorization, and it was not intended to include and describe in bibliographic detail all published and available articles. This allows publications not covered in the current work to be included in an updated overview paper later.*

Date of Submission: 15-03-2026 Date of acceptance: 31-03-2026

I. Introduction

In the review article by [1], it is noted that more than two-thirds of mangosteen, known as "the queen of fruit", is waste, with the peel alone accounting for 60% – 65%. Mangosteen peel can be utilized as activated carbon, sensitizer, dye or pectin extraction; whereas oil can be extracted from mangosteen seed [1]. Various properties and utilization of mangosteen in food science, postharvest biology, engineering and materials science are discussed by Aizat and co-authors in their review [2]. One of the most important sources of natural antioxidants is mangosteen peel [3]. According to [4], peel of mangosteen contained high amount of phenolic compounds and possessed antioxidant activity.

This overview paper aims to present some main highlights of the current options for effective mangosteen waste valorization in the context of the management aspects of this waste.

II. Materials and Methods

In connection with the fulfillment of the objective thus set, a literature survey was carried out on the keywords "mangosteen waste" among English-language sources in different databases. As a result, only scientific publications were considered and selected; while book chapters remained beyond the scope of the present paper. The articles included here are far from exhausting all accessible and available scientific literature on the mentioned subject, since the purpose of this overview is not to describe bibliographically all possible literary sources, but only to outline the main framework with some priority directions and aspects regarding the possibilities of mangosteen waste valorization.

III. Results and Discussion

In Figure 1, the scientific articles used here are systematized by content of main base terms in their titles.

* Corresponding author: v_jivkova@abv.bg

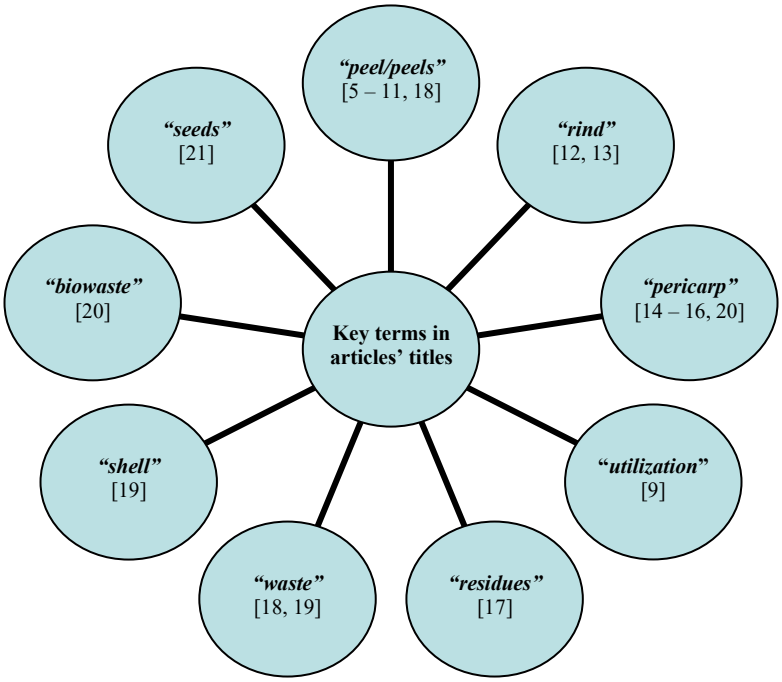

Fig. 1. Systematization of the publications cited in this paper by some key terms in their titles.

In the titles of the articles cited here on the valorization of mangosteen waste, the terms "peel/peels", "rind", "waste", "biowaste", "pericarp", "shell", "residues", "utilization", "seeds" can be found (Fig. 1). The author of this paper has considered this way of illustrating key terms to be appropriate, which will help to lay a suitable foundation for expanding the scope of the study in the future.
In Table 1, some valorization highlights found for mangosteen waste are presented.

Table 1. Systematized presentation of the publications cited in this paper on mangosteen waste valorization.

Highlights	**Reference**
evaporative cooling pad material	[5]
biochar carbon microparticles	[6]
botanical shampoo	[7]
patch herbal mixture – wound healing	[8]
burn wound plaster	[9]
drying	[10]
carbon dots	[11]
anthocyanin extraction	[12]
rind extract juice bioconversion	[13]
chemical composition and bioactive potential	[14]
drying – anthocyanins composition – antioxidant properties	[15]
anthocyanin extraction	[16]
renewable Pickering emulsifier	[17]
electrode materials for supercapacitors	[18]
cadmium ions adsorption	[19]

pericarp processing schemes	[20]
nutritional characteristics	[21]

The author of this overview does not intend to compare and comment on quantitative data from the various publications used here, as he believes that this goes beyond the stated goal of presenting a general framework of main highlights of research trends regarding the possibilities of effective management of mangosteen waste. The overview made reveals that intensive research is being carried out in various directions and areas (Table 1), which shows that ways are being sought for the effective valorization of mangosteen waste to the maximum extent.

IV. Conclusions

As a result of the literature survey, it can be concluded that the main research framework regarding the possibilities of effective valorization of mangosteen waste includes various directions. For example, based on the research summarized in this paper, the following highlights can be specified in conjunction with the main terms present in the article titles: evaporative cooling pad material (*"peels"*); biochar carbon microparticles (*"peel"*); botanical shampoo (*"peel"*); patch herbal mixture – wound healing (*"peel"*); burn wound plaster (*"utilization"*, *"peel"*); drying (*"peel"*); carbon dots (*"peel"*); anthocyanin extraction (*"rind"*, *"pericarp"*); rind extract juice bioconversion (*"rind"*); chemical composition and bioactive potential (*"pericarp"*); drying – anthocyanins composition – antioxidant properties (*"pericarp"*); renewable Pickering emulsifier (*"residues"*); electrode materials for supercapacitors (*"waste"*, *"peel"*); cadmium ions adsorption (*"waste"*, *"shell"*); pericarp processing schemes (*"biowaste"*, *"pericarp"*); nutritional characteristics (*"seeds"*). The research conducted by scientists from all over the world aims to reduce the waste generated and its effective utilization. The main areas of mangosteen waste valorization outlined here could be supplemented, expanded and enriched in a further updated overview paper.

References

[1]. C.Y. Cheok, N. Mohd Adzahan, R. Abdul Rahman, N.H. Zainal Abedin, N. Hussain, R. Sulaiman, G.H. Chong, Critical Reviews in Food Science and Nutrition **58(3)**, 335-361 (2018)
[2]. W.M. Aizat, F.H. Ahmad-Hashim, S.N.S. Jaafar, Journal of Advanced Research **20**, 61-70 (2019)
[3]. W. Suttirak, S. Manurakchinakorn, Journal of Food Science and Technology **51(12)**, 3546-3558 (2014)
[4]. A. Rohman, M. Rafi, G. Alam, M. Muchtaridi, A. Windarsih, Journal of Applied Pharmaceutical Science **9(08)**, 047-052 (2019)
[5]. N. Chaomuang, T. Nuangjamnong, S. Rakmae, AgriEngineering **5(4)**, 1865-1878 (2023)
[6]. A.B.D. Nandiyanto, M. Fiandini, D.A. Fadiah, P.A. Muktakin, R. Ragadhita, W.C. Nugraha, T. Kurniawan, M.R. Bilad, J. Yunas, A.Sh.M. Al Obaidi, Journal of Advanced Research in Fluid Mechanics and Thermal Sciences **105(1)**, 41-58 (2023)
[7]. S.-H. Sang, K.B. Liew, S.-K. Lee, J.-W. Keng, S.-K. Lee, G.A. Akowuah, C.S. Tan, Y.-L. Chew, Cosmetics **10(4)**, 109 (2023)
[8]. M.E. Gondokesumo, Y. Antonius, Y.E. Agustin, Pharmacognosy Journal **15(3)**, 461-466 (2023)
[9]. K.Q. Sani, P. Paulina, P.K. Insyira, Equilibrium Journal of Chemical Engineering **7(2)**, 147-152 (2023)
[10]. E.T.d.V. Silva, A.J.M. de Queiroz, R.M.F. de Figueirêdo, H.V. Moura, A.P.d.F. Silva, F.S. dos Santos, Y.F. Paiva, C.F.C. Palma, M.M.T. Saraiva, N. de Macedo Albuquerque Júnior, LWT – Food Science and Technology **198**, 115981 (2024)
[11]. S. Sugiarti, I. Safitri, N. Darmawan, Jurnal Pijar Mipa **19(2)**, 288-294 (2024)
[12]. Z.L. Tan, C.Y. Cheok, IOP Conference Series: Earth and Environmental Science **1372**, 012067 (2024)
[13]. D. Di Menna, N. Buranavanitvong, C. Prakitchaiwattana, Food Agricultural Sciences and Technology **10(2)**, 32-42 (2024)
[14]. B.R. Albuquerque, M.I. Dias, J. Pinela, R.C. Calhelha, T.C.S.P. Pires, M.J. Alves, R.C.G. Corrêa, I.C.F.R. Ferreira, M.B.P.P. Oliveira, L. Barros, Foods **12(5)**, 994 (2023)
[15]. N.I.M. Nawawi, G. Ijod, F. Abas, N.S. Ramli, N. Mohd Adzahan, E. Mohamad Azman, Foods **12(12)**, 2351 (2023)
[16]. G. Ijod, N.I.M. Nawawi, R. Sulaiman, M.R. Ismail-Fitry, N.M. Adzahan, F. Anwar, E.M. Azman, Food Chemistry: X **24**, 101882 (2024)
[17]. M. Yahya, S.C.W. Sakti, M.Z. Fahmi, C.H. Chuah, H.V. Lee, International Journal of Biological Macromolecules **257**, 128696 (2024)
[18]. E. Taer, W.M. Nasution, A. Apriwandi, R.T. Ginting, R. Taslim, Journal of Physics: Conference Series **2672**, 012013 (2023)
[19]. F. Ogata, Y. Uematsu, N. Nagai, I. Kobata, A. Tabuchi, C. Saenjum, T. Nakamura, N. Kawasaki, Heliyon **9(3)**, e14503 (2023)
[20]. A. Soontornwat, T. Pongsuttiyakorn, S. Rakmae, E. Sritham, P. Sirisomboon, U.K. Pun, W. Krusong, P. Pornchaloempong, Foods **13(14)**, 2286 (2024)
[21]. N. Saelee, R. Castro-Muñoz, W. Panpipat, M. Chaijan, Foods **13(18)**, 2987 (2024)