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EXTRACTION OF BIOACTIVE COMPONENTS OF WALNUT PRESS-CAKE AND APPLICATION OF IT AS ANTIOXIDANTS

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A brief overview of the walnut kernel and walnut press cake - a residue of the walnut oil extraction process presented at the beginning of the thesis process, describing its general characteristics, health benefits, and antioxidant properties. The walnut kernel is a rich source of proteins, fats, vitamins, minerals, and antioxidants, which contain health-promoting properties, have a preventive effect on inflammation, they decrease the risk of high blood pressure; in addition to prevent arterial illnesses that can result in heart, and brain stroke, chest diseases, and certain cancer types, making the fruit indispensable for human nutrition. In the next chapter of the literature review, the term antioxidants and its activity in the case of walnuts was mentioned, particularly polyphenols, which include phytochemicals subgroups such as flavonoids, isoflavones, phenolic acid, tannins, tocopherols and other low-molecular-weight compounds such as polyunsaturated fatty acids. These different polyphenol subgroups in walnut press-cake may differ significantly in content, stability, bioavailability, as well as physiological functions related to human health, and all of them less or more exhibited antioxidant activity. They complement and add to the functions of antioxidant vitamins and enzymes as a defense against oxidative stress and can serve as an excellent alternative to synthetic counterparts.

The walnut kernel contains numerous nutrition compounds, making it widely consumed as a whole nut or walnut oil. However, walnut residues are frequently abandoned as a by-product of walnut oil extraction, thrown away as waste, used as animal feed, composted, or even polluting the environment. Recent studies on walnut residues have demonstrated their health benefits through various aspects, involving the analysis of bioactive components and their activity, providing a theoretical basis for further processing, my study aims to contribute to this research process by examining the walnut residue polyphenol content and its application as an antioxidant in food processing through two main experimental series.

In my first series of tests, I determined some nutritional properties of walnut press-cake by testing polyphenol content in particular and antioxidant activity in general by applying different extraction methods, involving both conventional and advanced extraction, intended for comparison of their performance. Simultaneously, prevalent laboratory analytical methods such as total phenolic content (TPC) and ferric-reducing antioxidant power (FRAP), color analysis were employed. Based on the results, it can be affirmed that walnut press-cake extract has significant polyphenol content and antioxidant capacity, indicating this material's potential in food processing. On the other hand, the

effectiveness of the extraction methods is shown, the application of the ultrasound-assisted extraction method indicated a higher quantity of antioxidants mainly due to its mechanism, this method not only helps improve the extraction efficiency but also the cost-effective procedure for extracting phenolic compounds from plant materials.

Subsequently, different evaporation and drying methods were applied, I tested two different rotary evaporators, the first equipment used oil-bath instead of a water bath, and due to a lack of an accompanying vacuum pump, the extract quickly evaporated, since it could not adjust the temperature below 70°C to prevent the bioactive components from being deteriorated by thermal effects. Those limitations have been overcome with the application of another rotary evaporator that uses a water bath to raise the rotating flask's temperature and can be adjusted to reach the expected heat treatment. However, the evaporated extract still contained water, this solvent was also separated by applying two different drying methods, however drying by the dry cabinet at 105°C has caramelized the sample, ultimately, the freeze-drying is then applied and effectively achieves the desired result.

In the second experimental series, I mapped the basic attributions of the walnut press-cake extract dried powder as an antioxidant in application with sunflower oil whether it can modify the oil's physical characteristics, and the changes in the practical function of sunflower oil were examined. The samples were mixed with sunflower oil in different proportions, and then the free fatty acids value in terms of oleic acids content was determined. Result indicated that by mixing walnut press-cake powder with sunflower oil, free fatty acids are reduced, and the effectiveness of the process is proportional to antioxidant levels.

In this research, I gained a deeper understanding of the properties, and mechanisms of antioxidants, specifically polyphenols in walnut press-cake. I have chosen a suitable extraction method through the first experiment series, and besides that, the comparison between other extraction methods, and different extraction conditions, such as temperature, time, solvent, and solvent ratio, has also drawn my attention. The most appropriate drying process was selected. The use of antioxidants to reduce unsaturated free fatty acids in cooking oil was also successfully evaluated. As a result of the experimental results, I believe it is necessary to further investigate the activities of walnut press-cake bioactive compounds; reusing this material in food production is an interesting concept and deserves a lot of consideration.