**ENERGY VALORIZATION OF FRUIT SHELLS AND STONES DERIVING FROM THE FOOD INDUSTRY**

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**Keywords.** Fruit shells, fruit stones, biomass, energy enhancement.

**Abstract.** Shells and stones represent the main residues deriving from the processing of nuts and fresh fruit of some tree crops, in particular hazel, almond, walnut, pistachio, olive, peach and apricot. These residual biomasses currently constitute mainly a cost for companies producing nuts, jams and olive oil, for the purposes of their management and disposal.

The present study aims to investigate the main physical and chemical characteristics of shells and stones derived from the processing cycles from various Italian companies, for their use for energy purposes in biomass boilers. Analyzes were carried out according to international and European standards on solid biofuels in order to determine moisture content, calorific value, ash content, bulk density, ash fusibility and analysis of micro and macro elements.

The bulk density is comparable to the values of the wood chips. In particular, it is convenient to mill the material to obtain values of 400- 450 kg/m3. In detail, the shells have lower values than those found in the stones. Overall, shells and stones have good average lower heating value (LHV0) values ranging from 15.5 to 20 MJ/kg in line with other woody biofuels currently used in medium-large size power plants. No significant differences were found for LHV0 between samples of the same group (shells and stones). The ash content of all samples is less than 1.5%, a value comparable to wood chips (A1 class). However, as regards the analysis of the ash fusibility, all the species analyzed have deformation temperature (DT) below 1000 °C, except for peach and apricot stones, which have higher melting temperatures. From the chemical analysis, the macro and microelements found in the samples have lower values than those indicated by the EN ISO 17225-1:2021 standard. Apricot stones and walnut shells have a nitrogen content (N) higher than 1%. Overall, fruit shells and stones have the right characteristics to be enhanced for energy purposes. However, it would be appropriate to use them in medium-large size power plants due to the presence of low melting ash.