Abstract

The date palm tree (Phoenix dactilyfera L.) constitutes an interesting and dominant resource of biomass fuel in the oasis eco-system due to its several assets (availability, biodiversity, renewable aspect, significant energy potential). A feasibility study of energy recovery from this valuable biomass requires an accurate and thorough knowledge of all its components. This study aims to chemical characterization of the phoenicicole biomass to better apprehend the process of energy extraction. The main biomasses considered in the current work are two dominant date palm cultivars (Deglet Nour (DN) and Ghars GH) in the Guerrara oasis (Algeria). The date palm tree phoenicole byproducts are of a particular interest namely fibrilium (LIF), palms (DJ), date palm petiole (KER), fruit bunch (ARJ), spathe (KH), date palm rachis (AD), and fruit stalk pruning (SA). The approach followed to determine the chemical composition of the considred biomasses is based on thermochemical transformation. This includes the proximate analysis (moisture, ash, volatile matter, and fixed carbon content), the ultimate analysis (C, H, N, S, and O composition) and the calorimetry (higher heating value HHV). To complete this experimental study, we computed the elementary composition and the calorific value using numerical models. An analysis of the links between these parameters was also conducted. Through the study of approximate composition it has been found that the moisture content is relatively small and ash concentration varies between the studied cultivars and their byproducts. Typical found value varies between 5 to 20%. The energetic aspect of the studied phoenicicole biomass indicated an appreciable calorific value of all samples (18 MJ/kg), except fibrilium part, which presented lower values (15 MJ/kg). In addition, the energy value of biomass of DN cultivar is greater than that of GH cultivar. The elementary composition CHO analysis shows a big compatibility of the studied biomass with conventional biofuel feedstock mainly agricultural waste and wood. The analysis of S and N contents shows low values (<0.2% and <0.4%, respectively), which exhibits a very advantageous characteristic for the studied biomass. Finally, the comparison between the HHV measured and the computed values is not satisfactory (average error around 10%), this study identified the application limit of the four models for HHV calculated from the proximate composition. While the calculation of the elementary composition reveals good results for the studied parts (average error around 2%) whose ash content does not exceed 11%