

PRODUCTION OF CHARCOAL

Malik Ivan, Miroshnichenko Denis, Veisberh Olha

National technical University

«Kharkiv Polytechnic Institute», Kharkiv

Charcoal, the main product from carbonization (slow pyrolysis) of biomass, has a wide range of applications in various industries, which among others include direct combustion of charcoal as solid fuel, gasification of charcoal for synthesis gas production, purification of flue gases, desulfurization gases or water, and use as a reductant alternative to fossil carbon in metallurgical industry, etc.

In 2017, 51.2 million tons (Mt) of wood charcoal were produced globally, up from 37.0 Mt in 2000. From 1993 to 2017, the largest average amounts of charcoal were produced annually in Africa (24.6 Mt), with 57 % of the global production, followed by the America (23 %, mostly Latin America), and Asia. In Europe and North America, charcoal is used extensively as leisure fuel (e.g., for barbeques). 40 % of the charcoal used in Europe is imported from Africa, with Nigeria, Egypt, Namibia, and South Africa as key players. Intra-European charcoal trade also exists, with Ukraine, Lithuania, and Latvia as main suppliers to Belgium, Germany, and Poland. Global charcoal imports and exports are estimated at US\$1.16B. From 1993–2017, the world's top 10 charcoal-producing countries generated an average of 24.5 Mt of charcoal annually, more than 50 % of which were produced by Brazil, Nigeria, and Ethiopia. The US\$784M charcoal exports are mainly sourced from the tropical rainforests of Indonesia. Incidentally, some of the countries with low risk to energy security, defined as the continuous availability of energy at an affordable price, including Germany, Japan, France, and the UK, are among the top importers of charcoal.

The raw material for carbonization, its gathering and preparation constitute the single most important aspect of charcoal manufacture no matter what method of carbonization is used. Raw materials are divided into two groups: those derived from trees, i.e. wood in some form or other and those derived from agriculture, the so-called agricultural residues. These substances when carbonized give strength to be charcoal. High strength charcoal requires wood or nut shells as raw material. If lump charcoal is needed then wood is practically the only material though coconut shells produce strong charcoal suited for gas absorption purposes in a size adequate for his application. The conventional charcoal production consumes a large amount of energy due to the prolonged heating time and cooling time which contribute to the process completing in one to several days. Wood pyrolysis consists of both endothermic and exothermic reactions, as well as the decomposition of different components at different temperature range (473–733 K for hemicellulose; 513–623 K for cellulose and 553–773 K for lignin).

Data for European hardwoods that show the marked rise in heat and electricity use, when the moisture content increases. Increased moisture input to the system reduces the installed capacity of the plant and slows down production. Moreover, it is important to keep the moisture content of the wood entering the retort to around 30 % or less. Otherwise the gas coming from the retort is difficult to burn and will not produce the hot inert heating gas needed.