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NON-THERMAL PLASMA TECHNIQUE APPLIED TO WASTE CARBONISATION

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Pyrolysis means to split the volatile components from the carbonaceous solid material of waste in a thermochemical way that is controlled by a direct heat supply to the material in an inert atmosphere. At temperatures about 350°C cracking prevails. This means that (liquid) hydrocarbons will be formed basically from the primary tar compounds. At higher temperatures hydrogen is prone to be formed. The yield tends to increase at elevated temperatures reaching a maximum around 650°C. Preliminary test have confirmed that the hydrogenation of radicals may increase the yield of liquid fuel. The system enables poly-generation of energy (heat, hydrogen) and materials (liquid hydrocarbons, solid chemical products). At temperatures around 950°C basic carbon (fix carbon or active carbon) is formed from the carbonised material.

The method for flue gas cleaning with possible application to combustion and carbonization process uses non-thermal plasma based pilot system for 50-250 m^3/hour of gas flow. The applied method cleaned very efficiently the exhaust gas from variety of non-wanted compounds, utilises whole combustion exhaust. CO_2 removal efficiency is as high as 40-99%. The process is connected with nitrogen fixation, removal of NO_X, VOC, PAH, -SH and SO_X, PCDD, PCDF and other with high efficiency and without waste water production. The energy required for the conversion exhaust into solid amino acids condensation product was 2.3-4.7 Wh/m^3, i.e. 8.3-16.9 kJ/m^3.

The final solid amino acids condensation product (proteinoid) made in electric discharge seems to be convenient as nitrogen containing fertiliser. The final product of the process is a powder with a fractal structure on the microscopic level with low specific weight, insoluble in water. The product was analysed using IR absorption spectrometry, microscopic and SEM photography, HPLC, thermogravimetry and X-diffraction. The following amino acids were observed in the final product: alanine, serine, glycine, aspartic acid, lysine, arginine, methionine, histidine.