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Gasification of Jordanian oil shale using nitrogen non-thermal plasma

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In this study, oil shale gasification using low temperature, near atmospheric pressure nitrogen plasma has been examined. Oil shale samples (average moisture content 1.82%, volatile content 21.21%, fixed carbon content 13% and ash content 63.27%) were exposed to ion bombardment leading to the ejection and conversion of solid phase carbon and oxygen atoms into gas. The benefit of this method is that oil shale gasification can be performed without water and operates safely at low power (300 W). The basic requirement for oil shale gasification includes generating atmospheric pressure plasma at relatively low temperatures (200 – 550°C) using a pulsating high voltage at a frequency of 40 kHz. In addition, a rotating motor moves the oil shale, increasing the surface over which the plasma reaction occurs. Our experiments have examined the influence of key parameters including the nitrogen plasma mass flow rate (7 - 10 L/min), the mean diameter of the oil shale particles (0.2 - 10 mm) and the height of the plasma nozzle over the oil shale (5 - 15mm). It has been found that the maximum gasification percentage obtained is 23.0% of the original oil shale weight when a 10 L/min nitrogen flow rate is employed.