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Test results relating to changes in oil yield and gas compositions of oil shale samples subjected to short-to-medium time and temperature exposure at atmospheric pressure

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Since 1974, UMATAC Industrial Processes has been involved in applied research and development of the Alberta Taciuk Processor and its related systems for applications in processing oil sand, oil shale, heavy oil, and hydrocarbon contaminated waste. During this period UMATAC has evolved and developed test procedures and test equipment to assess and study the particular process variables relating to drying, thermal pyrolysis, combustion, heat transfer, and by product characterization as they relate particularly to the ATP Process which operates at atmospheric pressure conditions. During the thousands of tests UMATAC has carried out on oil sand and, in particular, oil shale from various parts of the world, it has noticed that even with short-term exposure of oil shale to drying and preheating temperatures below 350 °C there is a marked decrease in recovered oil products as compared to results obtained from the Fischer assay analysis. This was particularly evident during test programs carried out on lignite coals from China and Eastern United States. During 2008, UMATAC completed a series of test programs to measure and observe the rate of oil production, specific gravity of the oil, rate of gas production, analysis of the gas components, and the measured coke levels in the final processed solids as influenced by varying exposure time and soak temperatures. Based on published information and conference papers available from various in situ schemes, UMATAC initially expected oil recoveries to be in the range of 70% to 80% of Fischer assay and the oil equivalent hydrocarbon in the gas stream to be in the range of 25% to 40% of Fischer assay. The actual results obtained were significantly lower than these values. Several additional test programs were carried out to verify the results initially obtained. This paper presents an overview of the results that UMATAC obtained from these oil shale “soak” tests and summarizes the findings based on data from these various tests. The author emphasizes that these tests were carried out on 12 mm maximum crushed shale samples, in several different types of apparatus, and operated at ambient pressure. These controlled conditions do not necessarily represent actual in situ conditions such as the temperature profile, the pressure profile, and the oil shale bed permeability.