

BRIEF SUMMARY OF THE INVENTION

In one aspect, ~~the present disclosure~~ invention is directed toward methods of producing useful products from carbonaceous materials. Such methods include:

(i) contacting a carbonaceous material, such as coal, from a deposit, with one or more chemicals, to solubilize the material in preparation for further processing, such as bioconversion, to produce useful products, or

(ii) solubilizing the carbonaceous material in a formation using chemicals, removing the solubilized material from the formation and bioconverting it to produce useful products, or

(iii) solubilizing a carbonaceous material in a formation by adding chemicals to solubilize it and then and bioconverting at least a portion of the solubilized material while still in a formation using endogenous or exogenously added agents to produce useful products that can be recovered from the formation.

In separate embodiments, the solubilization chemicals include an organic acid (e.g., a carboxylic acid) of up to 4 carbon atoms or a benzoic acid, or a salt or ester of any of these acids. A preferred embodiment uses esters of acetic acid.

In a first aspect of the present disclosure, there is provided a method of treating a carbonaceous material comprising naturally occurring carbon-containing compounds, comprising:

contacting the carbonaceous material with one or more esters of acetic acid selected from the group consisting of methyl acetate, ethyl acetate, propyl acetate, isopropyl acetate, n-butyl acetate, isobutyl acetate, amyl acetate, isoamyl acetate, hexyl acetate, heptyl acetate, octyl acetate, nonanyl acetate, decyl acetate, undecyl acetate, lauryl acetate, tridecyl acetate, myristyl acetate, pentadecyl acetate, cetyl acetate, heptadecyl acetate, stearyl acetate, behenyl acetate, hexacosyl acetate, triacontyl acetate, benzyl acetate, bornyl acetate, isobornyl acetate and cyclohexyl acetate, thereby solubilizing at least a portion of the naturally occurring carbon-containing compounds in the carbonaceous material.

Chemicals and other agents can be added to a formation using a well, or well bores, that are then also available for removal of solubilized material or solubilized and bioconverted material.

~~Another aspect of the~~ The present ~~disclosure~~ invention is also directed towards a composition comprising solubilized derivatives of a carbonaceous material, which derivatives are then available for bioconversion to hydrocarbons, such as methane, and other derivatives useful as fuels in energy production.

In a second aspect of the present disclosure, there is provided a composition comprising the solubilized portion of the naturally occurring carbon-containing compounds in the carbonaceous material produced by the method of the first aspect.

The geological formations useful for practicing the present disclosure invention include subterranean formations, such as coalseams, shales, and oil sands, that contain useful carbonaceous materials.

The methods of the present disclosure invention include processes wherein the chemicals
5 are heated and then injected into a coal-bearing formation to solubilize coal contained therein. In a further example, such injection is carried out in combination with sonication to solubilize coal. Such methods are also available for treatment of a carbonaceous material after it has first been mined from a geological formation.

10 Where the carbonaceous material is coal, such coal is preferably a kind containing the largest amounts of fixed carbon and the smallest amounts of moisture and volatile matter.

BRIEF DESCRIPTION OF THE DRAWINGS

15 Figure 1 is a representative schematic plan view of a subterranean deposit of a hydrocarbon bed useful in explaining certain principles of the present invention. An ISBC process will include "patterns" of injection and production wells, and optionally include additional wells that may allow for the monitoring of the process – recording of pressure, temperature and flow data
20 and sampling of formation fluids. The number and location of the monitoring wells would be carefully determined based upon a number of factors.

Figure 2 is an isometric view of a portion of the deposit and related terrain of FIG. 1. In order to implement in-situ bioconversion of carbonaceous material, preferably coal, to methane ("ISBC"), a series of wellbores must be
25 drilled into a coalseam and hydraulic connection established between the coalseam and the wellbore. Each injection well wellbore is then equipped so as to enable the injection of water, nutrients and chemicals from the surface into the coalseam, and devices that enable determination and recording of data such as pressure, temperature, and flowrate. Each producing well is then
30 equipped so as to enable the production of water and generated gases and