[00013] One major drawback of the processes disclosed in the prior art as described in the above patents is the use of relatively high temperature, pressure, and/or expensive solvents such as alkali metal hydroxides or oxidizing agents such as pure O_2 or other costly oxidizers. Such severe conditions result in prohibitive raw material and/or energy costs, making such processes uneconomical on an industrial scale. These processes also typically result in a product stream or gaseous products that are incompatible with a subsequent microbial conversion step.

[00014] An improved process is needed that utilizes milder conditions and yet provides efficient oxidative depolymerization of carbonaceous feedstocks and enhances the biodegradability of the resultant products to chemicals and biogas. Such an improved process can lower the cost of producing clean fuels and industrial raw materials from carbonaceous feedstocks thereby improving the economic viability of such processes.

SUMMARY

[00015] [1]. In one aspect, the present disclosure provides a method for solubilizing a carbonaceous feedstock, comprising the steps of a. reacting a mixture of the carbonaceous feedstock with a metal oxide including a metal at a first, higher oxidation state to reduce the metal of the metal oxide to a second, lower oxidation state by releasing at least one oxygen atom to oxidize at least one component of the carbonaceous feedstock; b. oxidizing at least a portion of the metal or metal oxide containing the metal at the second, lower oxidation state to the first, higher oxidation state, and c. recycling at least a portion of the metal oxide containing the metal at the first, higher oxidation state from step (b) back to step (a).

[00016] [2]. The method of [1], wherein the metal oxide comprises a transition metal selected from the group consisting of lanthanides and actinides.

[00017] [3]. The method of any one of [1-2], where the metal oxide comprises a metal selected from Fe, Ti, Cu, Ni, V, Cr, Mn, Co, Mo, La, Ce, Zr, Sr, W, Rh, Ba, Pt, Pd, and Ag.

[00018] [4]. The method of any one of [1-3], wherein in the reacting step the weight ratio of metal oxide to the carbonaceous feedstock is in a range of from about 0.1:100 to about 10:100, or from about 0.5:100 to about 5:100, or from about 1:100 to about 3:100.

[00019] [5]. The method of any one of [1-4], wherein the metal oxide is on an inert support.

[00020] [6]. The method of [5], wherein the inert support comprises a material selected from carbon, activated carbon, pumice, alumina, silica, silica-alumina, magnesia, diatomaceous earth, bauxite, titania, zirconia, clay, magnesium silicate, silicon carbide, zeolites, ceramics, carborundum, quartz, thoria, chromite, rutile, illmenite zircon, bauxite and combinations thereof.