PRODUCED WATER AS A POTENTIAL WATER SOURCE FOR GROWTH AND PROCESSING OF ALGAE FOR BIOFUEL

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Waters from oil and gas production can provide a sustainable alternative to fresh water sources for algae cultivation while providing a path forward for beneficial use. Produced water contains a variety of chemical species, both beneficial and harmful to algae growth and processing. The speciation (and thus oxidation state) of a species determines its bioavailability and toxicity in the environment and in algae cultivation ponds. For example, at optimal concentrations, iron species are beneficial to algal heath, where Fe(II) is the more soluble and therefore more bioavailable form of iron. On the other hand, the presence of harmful oxyanion species such as chromate (Cr(VI)) increase the toxicity of coproducts, such as animal feedstocks. This may necessitate water pretreatment, resulting in an increase in overall algae fuel production costs. By using geochemical models along with chemical analyses of produced water, oxyanion speciation can be predicted in response to nutrient addition (i.e., CO2, oxygen and salt), pH changes and evaporation. Preliminary results indicate that as CO2 (necessary for algae growth) is added, the pH decreases and Cr(VI) is reduced to the less mobile and less toxic Cr(III) oxidation state. In contrast, as chromium becomes more concentrated during evaporation (without CO2 addition), the ratio of Cr(VI) to Cr(III) is increased. Similar results are obtained for iron where the ratio of Fe(III) to Fe(II) increases during evaporation, and decreases as CO2 is added. Geochemical models can be a useful tool in evaluating produced waters as viable alternatives to fresh water in algae growth and processing, the use of which will decrease production costs and increase the price competitiveness of biofuel from algae.

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