Industrial membrane filtration and fractal separation systems for separating monomers from heterogeneous plant material

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The technology already exists for using acid or enzyme hydrolysis processes to convert biomass feedstock (i.e., waste cellulose such as straw, corn stover, and wood) into their base monomeric sugar building blocks, which can, in turn, be processed into chemicals and fuels using a number of innovative fermentation technologies. However, while these processes are technically possible, practical and economic barriers make these processes only marginally feasible or not feasible at all. These barriers are due largely to the complexity and large fixed and recurring capital costs of the filters, chromatographic separators, and ion exchangers. This project is removing these barriers by developing and implementing new purification and separation technologies that will reduce the capital costs of the purification and chromatographic separation units by 50% to 70%, thus achieving an overall processing plant economic benefit of about 25%. The technologies fundamental to these improvements are: (a) highly efficient clarification and purification systems that use screening and membrane filtration to eliminate suspended solids and colloidal material from feed streams and (b) fractal chromatographic separation and ion exchange systems that can substitute for conventional systems at approximately one tenth the size. These size reductions are achieved by using fractal fluid distribution. The benefit of these technologies will be the economic viability of converting renewable biomass to chemicals and fuels, thereby potentially saving more than 1 QBTU in petrochemical feedstocks.