

Abstract

The present invention relates to a liquid-phase hydrogenation reaction method with multi-stage hydrogen dissolution. A liquid material is circulated and mixed with a feedstock oil, and introduced into a heating furnace to be heated. Hydrogen gas is divided into n routes and introduced into the heating furnace to be heated. One route of hydrogen gas is mixed with a liquid-phase material in a mixer for a first stage hydrogen dissolution. The remaining $(n-1)$ routes of hydrogen gas are introduced into a hydrogen-oil mixing component in the reactor via an inlet of beds in the reactor to be mixed with a mixture from a reaction in a preceding bed for a second stage hydrogen dissolution. Reaction byproducts, namely hydrogen sulfide and ammonia, are stripped. A reaction pressure control system is arranged on the top of the reactor. An exhaust system is arranged at each section of the reactor. Reaction products are introduced into a stripping tower. The hydrogen-oil mixer is arranged in the stripping tower. The byproducts, namely hydrogen sulfide and ammonia, are stripped. Capacity for hydrogen dissolution is increased. A portion of an oil product that comes out from the stripping tower is introduced into a product tank, while another portion is recirculated. The present method has hydrogen sulfide and ammonia discharged from a reaction system while a hydrogenation reaction is catalyzed, and a solid-phase catalyst comes in contact with a liquid-phase reactant, thus increasing reaction efficiency.