REACTOR SPARGER ASSEMBLY

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application No. 63/031,257 filed on May 28, 2020 and entitled, "Reactor Sparger Assembly," which is incorporated herein by reference in its entirety for all purposes.

BACKGROUND

[0002] Spargers are typically designed to be located at the bottom of a reactor vessel, beneath a large volume of a process fluid, and designed to introduce a gas flow into the process fluid to promote a chemical or biological process. Depending on the system, the process fluid may contain both liquids and solids, including small particulates that can clog or otherwise obstruct the operation of the spargers. Servicing conventional spargers typically involves taking the reactor offline and draining the process fluid from the reaction vessel to access, clean, and/or repair the spargers. However, draining the process fluid from the reaction vessel can take hours or days, resulting in substantial operational costs and delays.

BRIEF DESCRIPTION

[0003] Certain embodiments commensurate in scope with the originally claimed invention are summarized below. These embodiments are not intended to limit the scope of the claimed invention, but rather these embodiments are intended only to provide a brief summary of possible forms of the invention. Indeed, the invention may encompass a variety of forms that may be similar to or different from the embodiments set forth below.

[0004] ~~In an embodiment~~According to a first aspect of the present invention, there is provided a reactor system ~~includes~~including a reactor vessel configured to contain a process fluid, and a sparger assembly that is operably coupled to the reactor vessel and configured to supply a gas and a recirculated process fluid to the reactor vessel. The sparger assembly can include a plurality of sparger chambers. Each sparger chamber can include a process fluid conduit fluidly coupled to a process fluid return of the reactor vessel via a process fluid inlet, where the process fluid inlet has a first block and bleed valve assembly. Each sparger chamber can include a sparger conduit fluidly coupled to the process fluid conduit and a sparger disposed within the sparger conduit and fluidly coupled to a gas source via a gas inlet. Each sparger chamber also includes a process fluid-gas mixture outlet that fluidly couples the sparger conduit to a sparger outlet of the reactor vessel, wherein the process fluid-gas mixture outlet comprises a second block and bleed valve assembly, wherein the first and

second block and bleed valve assemblies are configured to enable the sparger to be fluidly isolated from the reactor vessel.

[0004a] According to a second aspect of the present invention, there is provided a sparger assembly for a reactor, the sparger assembly including: a plurality of sparger chambers, and wherein each sparger chamber of the plurality of sparger chambers including: a process fluid conduit fluidly coupled to a process fluid inlet, wherein the process fluid inlet includes a first block and bleed valve assembly; a sparger conduit fluidly coupled to the process fluid conduit; a sparger disposed within the sparger conduit and fluidly coupled to a gas inlet; and a process fluid-gas mixture outlet fluidly coupled to the sparger conduit, wherein the process fluid-gas mixture outlet includes a second block and bleed valve assembly, wherein the first block and bleed valve assembly and the second block and bleed valve assembly are configured to enable the sparger assembly to be fluidly isolated.

[0005] ~~In an embodiment~~According to a third aspect of the present invention, there is provided a method of providing a gas to a fluid within a reactor ~~comprises~~that includes passing a process fluid to a sparger chamber through a first valve assembly, passing a gas through a sparger element within the sparger chamber, forming bubbles within the process fluid within the sparger chamber to form a mixed fluid, and passing the mixed fluid out of the sparger chamber and into a reactor vessel.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] These and other features, aspects, and advantages of the present invention will become better understood when the following detailed description is read with reference to the accompanying drawings in which like characters represent like parts throughout the drawings, wherein:

[0007] FIG. 1 is a graph representing the relationship between bubble diameter and a ratio of bubble surface area to bubble volume, in accordance with the presently disclosed embodiments;

[0008] FIG. 2 is a schematic diagram of an embodiment of a reactor system including a reactor vessel having a sparger assembly, in accordance with the presently disclosed embodiments;

[0009] FIG. 3 is a schematic diagram of a sparger plate of the sparger assembly, in accordance with the presently disclosed embodiments;

[0010] FIG. 4 is a schematic diagram of an embodiment of a sparger chamber of the sparger assembly, in accordance with the presently disclosed embodiments;

[0011] FIG. 5 is a schematic diagram of an embodiment of a header arrangement of the sparger assembly, in accordance with the presently disclosed embodiments; and