There has therefore long been felt a significant need to have innovative solutions that will allow industrial reactors to be emptied completely, rapidly, effectively and reliably of the spent catalyst particles they contain.

The applicant company has now discovered a novel technique for emptying reactors containing spent catalyst particles that makes it possible to overcome the disadvantages of the methods of the prior art.

SUMMARY

In one aspect of the present disclosure, there is provided a method for emptying a reactor containing at least one bed of spent catalyst particles and comprising at least one dump tube, which opens into the reactor at the bottom of the said bed of particles or underneath the latter, the method comprising the following successive steps:

- a first step consisting in causing a proportion of the bed of catalyst to flow out of the reactor via the said dump tube, then
- a second step of extracting the vestiges of catalyst, which is performed by sucking up the particles of catalyst remaining in the reactor at the end of the first step, using a flexible extraction sleeve introduced into the reactor via the said dump tube and connected to an extraction system situated outside the reactor, the said sleeve being provided on its external surface with protuberances and being able to move, inside the reactor, translationally and rotationally with respect to the said dump tube.

DESCRIPTION

One subject of the present invention is a method for emptying a reactor containing at least one bed of spent catalyst particles and comprising at least one dump tube, which opens into the reactor at the bottom of the said bed of particles or underneath the latter. The method according to the invention comprises the following successive steps:

- a first step consisting in causing a proportion of the bed of catalyst to flow out of the reactor via the said dump tube, then
- a second step of extracting the vestiges of catalyst, which is performed by sucking up the particles of catalyst remaining in the

reactor at the end of the first step, using a flexible extraction sleeve introduced into the reactor via the said dump tube and connected to an extraction system situated outside the reactor, the said sleeve being provided on its external surface with protuberances and being able to move, inside the reactor, translationally and rotationally with respect to the said dump tube.

The method according to the invention makes it possible to empty the reactor of its charge of spent catalyst in a particularly complete, effective and rapid way.

The method according to the invention also makes it possible to avoid any human intervention inside the reactor, and allows a very significant improvement in the safety of the operations of dumping the spent catalyst.

The method according to the invention finally makes it possible to preserve the properties of the spent catalyst and limit the damage it sustains as it is dumped, something which is essential when the

CLAIMS

1. Method for emptying a reactor containing at least one bed of spent catalyst particles and comprising at least one dump tube, which opens into the reactor at the bottom of the said bed of particles or underneath the latter, the method comprising the following successive steps:

- a first step consisting in causing a proportion of the bed of catalyst to flow out of the reactor via the said dump tube, then
- a second step of extracting the vestiges of catalyst, which is performed by sucking up the particles of catalyst remaining in the reactor at the end of the first step, using a flexible extraction sleeve introduced into the reactor via the said dump tube and connected to an extraction system situated outside the reactor, the said sleeve being provided on its external surface with protuberances and being able to move, inside the reactor, translationally and rotationally with respect to the said dump tube.

2. Method according to Claim 1, characterized in that the first step is performed under gravity, by causing a proportion of the bed of catalyst to flow out of the reactor under gravity via the said dump tube.

3. Method according to either one of the preceding claims, characterized in that during the course of the first step, the proportion of the bed of spent catalyst extracted from the reactor is greater than 50 wt% of the initial bed and preferably ranges from 60 to 95 wt% of the initial catalyst bed, more preferentially from 70 to 90 wt% of the initial catalyst bed.

4. Method according to any one of the preceding claims, characterized in that during the course of the second step, the sleeve is moved by guide means located outside the reactor.

5. Method according to the preceding claim, characterized in that the means of guiding the sleeve are controlled manually, automatically or semiautomatically.

6. Method according to any one of the preceding claims, characterized in that means of detecting the position of the sleeve are present inside the reactor.

7. Method according to the preceding claim, characterized in that said detection means comprise one or more camera(s) positioned on the internal wall of the reactor and/or on the sleeve.

8. Method according to any one of the preceding claims, characterized in that the protuberances at the surface of the sleeve comprise splines, teeth of varying degrees of roundedness or pointedness, brushes, or protuberances in the form of sausages, studs, pins, spikes or nails.

9. Method according to any one of the preceding claims, characterized in that the protuberances are present over the entire length of the extraction sleeve introduced into the reactor, or over a part of this length, for example only in the region of the suction head of the sleeve.

10. Method according to any one of the preceding claims, characterized in that the end of the sleeve introduced into the reactor is curved.

11. Method according to any one of the preceding claims, characterized in that the dump tube is horizontal or inclined downwards.

12. Method according to the preceding claim, characterized in that the dump tube is inclined downwards, with an angle of inclination with respect to the vertical ranging preferably from 0 to 75 degrees, more preferably 10 to 60 degrees.

13. Method according to any one of the preceding claims, characterized in that the said first step is preceded by a preliminary step of deagglomerating the catalyst, performed by injecting a pressurized inert gas such as carbon dioxide or nitrogen into the bed of catalyst.