asphaltenes present in the bottom residue of the plant by subjecting a sample of the residue to infrared (IR) light irradiation,

- converting the radiation exiting the irradiated sample into a signal (CV/IR parameter) correlated to the concentration of said particles,

characterized in that the operating conditions of the plant are corrected in accordance with the CV/IR value determined. In particular, when the CV/IR parameter detects a carbonaceous charge higher than a preset limit threshold, either a decrease of the furnace temperature and/or an increase of the amount of stabilizing additives in the plant charge will be operated, in order to obtain a decrease of the fouling potential of the plant.

When the CV/IR parameter detects a carbonaceous charge lower than the preset threshold, an increase of the furnace temperature will be operated, with the entailed increase of light distilled fractions.

The signal correlated to the concentration of the particles of carbon or of dehydrogenated asphaltenes in the sample advantageously automatically triggers a series of operations correcting the operating conditions of the plant.

In a preferred embodiment, the sample of residue analyzed is in non-diluted form and/or the determining of the concentration of particles of carbon or of dehydrogenated asphaltenes in the sample of residue and the correcting of the conditions are carried out with the plant during operation and in real time.

Another object of the invention is a method for determining the concentration of particles of carbon or of dehydrogenated asphaltenes in an oily fluid opaque to light radiations in the visible range, characterized in that a sample of fluid is subjected to infrared (IR) light irradiation and the radiation exiting the irradiated sample is reprocessed by an optically reading device into a signal correlated to the concentration of said particles, wherein the sample of opaque oily fluid, subjected to IR irradiation, is placed on a support transparent to IR radiation, in the form of layer of a thickness of 0.05 to 3 mm, and wherein said device carries out a counting of said particles on plural focal planes, whereby a three-dimensional reading is obtained.

Another object of the invention is an apparatus for determining the concentration of particles of carbon or of dehydrogenated asphaltenes in an oily fluid opaque to light radiations in the visible range, comprising an IR light source focusable on the sample to be analyzed, the IR light being able to pass through a sample of a thickness of 0.05 to 3 mm, means for counting of said particles on plural focal planes, means for receiving the radiation exiting the sample, means for transforming the exiting radiation into a signal correlated to the concentration of

particles present in the sample, and a reading chamber, wherein the reading chamber comprises an IR optical microscope.

Another object of the invention is a method of adjusting the operating conditions of a petroliferous thermal or catalytic conversion plant, comprising the following steps:

determining the concentration of particles of carbon or of dehydrogenated asphaltenes present in the bottom residue of the plant by subjecting a sample of the residue to infrared (IR) light irradiation, wherein the sample is placed on a support transparent to IR radiation, in the form of layer of a thickness of 0.05 to 3 mm;

converting the radiation exiting the irradiated sample into a signal (CV/IR parameter) correlated to the concentration of said particles,

characterized in that the operating conditions of the plant are corrected in accordance with the CV/IR value determined.

Description of the figures

Figure 1: Box A: Images obtained using the conventional CV. Box B: Other images obtained using CV/IR.

Figure 2: 3D elaboration of a 785 μm^2 CV field; the total volume of the particles is approximately 5%.

Figure 3: Graph showing the CV values (in μm^2) on the abscissa against the CV/IR values (in % of area) on the ordinate: the trend line, which refers to all points, has a coefficient R^2 equal to 0.95, showing a good correlation between the two sets of values.

Figure 4: Results obtained from analyses of the CV/IR parameter.

Figure 5: Example of a completely automatic system of an apparatus according to the present invention.

Figure 6: Chart of a lens used in an apparatus according to the present invention.

Detailed description of the invention

The innovative element of the methods and processes of the invention is the source of illumination of the sample: in the conventional methods for measuring particles, such as solid carbonaceous particles (of coke) and particles of dehydrogenated

8. An apparatus for determining the concentration of particles of carbon or of dehydrogenated asphaltenes in an oily fluid opaque to light radiations in the visible range, comprising an IR light source focusable on the sample to be analyzed, the IR light being able to pass through a sample of a thickness of 0.05 to 3 mm, means for counting of said particles on plural focal planes, means for receiving the radiation exiting the sample, means for transforming the exiting radiation into a signal correlated to the concentration of particles present in the sample, and a reading chamber wherein the reading chamber comprises an IR optical microscope.

9. The apparatus according to claim 8, comprising the following elements: an automatic sampler, a reading chamber, a signal reprocessing unit, or, alternatively, a signal reprocessing and transfer unit.

~~10. The apparatus according to claims 8 or 9 wherein the reading chamber comprises an IR optical microscope.~~

~~11.~~10. The apparatus according to claim ~~10~~ 9, wherein said IR optical microscope comprises an IR light polarizer.

~~12.~~11. The apparatus according to claim ~~11~~ 10, wherein said microscope can carry out readings on different overlapped focal planes, whereby a three-dimensional reading is obtained.

~~13.~~12. The apparatus according to any one of the claims 8 to ~~12~~11, wherein the signal reprocessing unit is a chamber coupled to a monitor for representing the image of the analyzed sample.

~~14.~~13. The apparatus according to any one of the claims 8 to ~~13~~12, comprising a thermostating chamber upstream of the reading chamber, and optionally means for removing the sample from the reading chamber.

~~15.~~14. The apparatus according to any one of the claims 8 to ~~14~~13, integrated into the thermal conversion plant via a bypass from the plant line.

~~16.~~15. A method of adjusting the operating conditions of a petroliferous thermal or catalytic conversion plant, comprising the following steps:

determining the concentration of particles of carbon or of dehydrogenated asphaltenes present in the bottom residue of the plant by subjecting a sample of the residue to infrared (IR) light irradiation, wherein the sample is placed on a

support transparent to IR radiation, in the form of layer of a thickness of 0.05 to 3 mm;

converting the radiation exiting the irradiated sample into a signal (CV/IR parameter) correlated to the concentration of said particles,

characterized in that the operating conditions of the plant are corrected in accordance with the CV/IR value determined.

~~17.~~16. The method according to claim ~~16~~15, characterized in that when the CV/IR parameter detects a carbonaceous charge higher than a preset limit threshold, either a decrease of the furnace temperature or an increase of the amount of stabilizing additives in the plant charge will be operated, in order to obtain a decrease of the fouling potential of the plant.

~~18.~~17. The method according to claim ~~17~~16, characterized in that when the CV/IR parameter detects a carbonaceous charge lower than a maximum acceptable threshold, an increase of the furnace temperature will be operated, with the entailed increase of light distilled fractions.

~~19.~~18. The method according to any one of the claims ~~16~~ 15 to ~~18~~17, wherein the signal correlated to the concentration of the particles of carbon or of dehydrogenated asphaltenes in the sample automatically triggers a series of operations correcting the operating conditions of the plant.

~~20.~~19. The method according to any one of the claims ~~16~~ 15 to ~~19~~18, wherein the sample of residue analyzed is in non-diluted form.

~~21.~~20. The method according to any one of the claims ~~16~~ 15 to ~~20~~19, wherein the determining of the concentration of particles of carbon or of dehydrogenated asphaltenes in the sample of residue and the correcting of the conditions are carried out with the plant during operation and in real time.