

EXHAUST POST-PROCESSING DEVICE, CONTROL METHOD THEREOF AND VEHICLE

[0001] The present application claims the priority to Chinese Patent Application No. 202310181940.4, titled "EXHAUST POST-PROCESSING DEVICE, CONTROL METHOD THEREOF AND VEHICLE", filed with the China National Intellectual Property Administration on March 1, 2023, which is incorporated herein by reference in its entirety.

FIELD

[0002] The present application relates to the technical field of vehicle, for example, to an exhaust post-processing device, a control method thereof and a vehicle.

BACKGROUND

[0003] A diesel particulate filter (DPF) is used to capture engine particulates, reducing the amount of dust emitted into the atmosphere. The particulates collected in the DPF can be burned off through an active or a passive regeneration.

[0004] Selective catalytic reduction (SCR) is an important technology for controlling engine NO_x emission. This technology involves: injecting a standard urea solution (urea concentration of 32.5%) for vehicle into an SCR mixer to encounter a high-temperature exhaust gas and to be heated to decompose ammonia (NH₃); reacting NH₃ with NO_x on the catalyst surface to realize reduction of NO_x; and ultimately converting the nitrogen atoms in NO_x into N₂ that is environmentally harmless, thereby reducing the content of NO_x in the engine exhaust.

[0005] An exhaust post-processing system is known in the related art. For example, a prior patent Application No. CN202011130667.5 disclosed a system for purifying NO_x from engine exhaust, which is provided with a primary SCR and a secondary SCR. The primary SCR is positioned between a diesel oxidation catalyst (DOC) and a DPF, and the secondary SCR is positioned after the DPF. The primary SCR operates during engine cold-start, whereas the secondary SCR primarily operates at a high exhaust gas temperature. Thus, it can precisely control the injection amount of dual urea injection valves based on the NO_x conversion

demand at different exhaust gas temperatures, thereby reducing NO_x emissions. If a passive regeneration is needed, the exhaust gas coming from the DOC has to flow through the SCR before entering the DPF, which may lead to decrease in exhaust gas temperature, affecting the passive regeneration efficiency.

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SUMMARY

[0006] An exhaust post-processing device, a control method thereof and a vehicle are provided in the present application, which can solve a problem of affecting the passive regeneration efficiency due to a decreased exhaust gas temperature caused by the fact that, after flowing through the DOC, the exhaust gas has to flow through the SCR before entering the DPF in the existing exhaust post-processing device.

[0007] In a respect, an exhaust post-processing device is provided in an embodiment of the present application, including a first processing device, a second processing device, a bypass pipeline, and a control valve, wherein the first processing device includes a first DOC, a DPF, and a first SCR sequentially arranged in an exhaust pipeline in a flow direction of an exhaust gas, and the second processing device is arranged upstream of the first processing device,

wherein the second processing device includes a second DOC and a second SCR sequentially arranged in the exhaust pipeline along the flow direction of the exhaust gas, and

wherein a first end of the bypass pipeline is in communication to an input end of the second DOC, and a second end of bypass pipeline is in communication with an output end of the second SCR, the control valve is configured to control connection or disconnection of the bypass pipeline.

[0008] In an embodiment, the exhaust post-processing device further includes a first urea injection device and a second urea injection device, wherein the first urea injection device is configured to feed urea into the first SCR, and the second urea injection device is configured to feed urea into the second SCR.

[0009] In an embodiment, the exhaust post-processing device further includes a first temperature sensor for detecting a temperature at an input end of the first DOC, a flow sensor for detecting a flow rate of exhaust gas at the input end of the first DOC, and a second temperature sensor for detecting a temperature at an input end of the DPF.

[0010] In another aspect, a control method of the exhaust post-processing device according to any technical solution described above is further provided. The control method includes:

determining whether a passive regeneration request is obtained;

opening the control valve in response to a determination of obtaining the passive
5 regeneration request; and

conducting a thermal management by the first processing device.

[0011] In an embodiment, the step of conducting the thermal management by the first processing device includes:

obtaining the temperature at the input end of the first DOC;

10 determining that the temperature at the input end of the first DOC exceeds the set temperature;

obtaining the flow rate of exhaust gas flowing through the first DOC;

obtaining the temperature at the input end of the DPF;

15 determine a feedforward fuel quantity based on the temperature at the input end of the first DOC and the flow rate of exhaust gas flowing through the first DOC;

determining a corrected fuel quantity based on the temperature at the input end of the first DOC, the flow rate of exhaust gas flowing through the first DOC, and the temperature at the input end of the DPF;

20 calculating the total fuel quantity equal to the sum of the feedforward fuel quantity and the corrected fuel quantity;

comparing the total fuel quantity with the set fuel quantity; and

using the total fuel quantity as the regeneration fuel injection quantity in response to a comparison result that the total fuel quantity is less than the set fuel quantity.

25 **[0012]** In an embodiment, the step of conducting a thermal management by the first processing device further includes: using the set fuel quantity as the regeneration fuel injection quantity in response to a comparison result that the total fuel quantity is not less than the set fuel quantity.

[0013] In an embodiment, the step of determining the feedforward fuel quantity based on the

temperature at the input end of the first DOC and the flow rate of exhaust gas flowing through the first DOC includes:

$Q = \text{flow rate of exhaust gas flowing through the first DOC} * \text{hot melt of the exhaust gas} * (\text{set value of regeneration temperature} - \text{temperature at the input end of the first DOC}),$

5 and

feedforward fuel quantity = $Q / \text{calorific value} / \text{conversion efficiency of HC in the first DOC},$

10 where, Q represents quantity of heat, and the set value of regeneration temperature, calorific value, and conversion efficiency of HC in the first DOC are all constants, and the hot melt of the exhaust gas is determined based on the temperature at the input end of the first DOC.

[0014] In an embodiment, the step of determining the corrected fuel quantity based on the temperature at the input end of the first DOC, the flow rate of exhaust gas flowing through the first DOC, and the temperature at the input end of the DPF includes:

15 determining the upstream set temperature of the DPF based on the temperature at the input end of the first DOC and the flow rate of exhaust gas flowing through the first DOC;

calculating a difference between the upstream set temperature of the DPF and the temperature at the input end of the DPF; and

determining the corrected fuel quantity based on the difference.

20 **[0015]** In an embodiment, the control method further includes keeping the control valve closed in response to a determination that the passive regeneration request is not obtained.

[0016] In another aspect, a vehicle is provided in the present application, including any exhaust post-processing device described above.

25 **[0017]** The exhaust post-processing device of the present application includes a first processing device, a second processing device, a bypass pipeline and a control valve. In a flow direction of the exhaust gas, the second processing device is arranged upstream of the first processing device. The first processing device includes a first DOC, a DPF, and a first SCR sequentially arranged in the exhaust pipeline along the flow direction of the exhaust gas, and the second processing device includes a second DOC and a second SCR sequentially

arranged in the exhaust pipeline along the flow direction of the exhaust gas. One end of bypass pipeline is in communication with the input end of the second DOC, and the other end of bypass pipeline is in communication with the output end of the second SCR. The control valve is used to control the bypass pipeline to be in communication or blocked. When there is a passive regeneration request, the control valve is opened to bypass the second processing device, which can reduce heat loss caused by the exhaust gas flowing through the second processing device, and increase the temperature at the input end of the first DOC and the content of NO₂ entering the DPF. When the temperature at the input end of DPF increases to the required temperature, it can effectively improve the passive regeneration rate, effectively balance the carbon load, extend the active regeneration cycle, and improve the user's work efficiency. Meanwhile, the efficiency of the first SCR increases when being at the high temperature, and the emission can be effectively ensured by increasing the urea supply to the first SCR.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] FIG. 1 is a schematic structural view of an exhaust post-processing device according to an embodiment of the present application;

[0019] FIG. 2 is a flow diagram of a control method of the exhaust post-processing device according to an embodiment of the present application; and

[0020] FIG. 3 is a flow diagram of a thermal management operated by a first processing device of the exhaust post-processing device according to an embodiment of the present application.

In drawings:

1 first DOC,	2 DPF,	3 first SCR,
4 ASC,	5 second DOC,	6 second SCR,
7 bypass pipeline,	8 control valve.	

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0021] The following will provide a clear and complete description of the technical solution

of the present application in conjunction with the accompanying drawings. Apparently, the described embodiments are a part of embodiments of the present application, not all of them. Based on the embodiments in the present application, all other embodiments obtained by those skilled in the art without paying creative work will all fall within the scope of the present application.

[0022] In the description of the present application, it should be noted that the terms "center", "up", "down", "left", "right", "vertical", "horizontal", "inside", "outside", etc. indicate that the orientation or position relationship based on the orientation or position relationship shown in the drawings is only for illustration of the present application and simplifying the description, rather than indicating or implying that the device or component referred to must have a specific orientation and be constructed and operated in a specific orientation, and therefore cannot be understood as a limitation of the present application. In addition, the terms "first" and "second" are only used for the purpose of illustration and cannot be understood as indicating or implying relative importance. Among them, the terms "first position" and "second position" refer to two different positions, and the first feature being "on", "above", and "over" the second feature includes the first feature being directly above and diagonally above the second feature, or merely indicates that the first feature is horizontally higher than the second feature. The first feature being "under", "below", and "beneath" the second feature includes the first feature being directly below and diagonally below the second feature, or merely indicates that the horizontal height of the first feature is less than that of the second feature.

[0023] In the description of the present application, it should be noted that, unless otherwise specified and limited, the terms "installation", "connection", and "connecting" should be broadly understood, for example, they can be fixed connections, detachable connections, or integrated connections. It can be a mechanical connection or an electrical connection. It can be directly connected, or indirectly connected through an intermediate medium, or it can be an internal connection between two components. It can be understood for those skilled in the art that the specific meanings of the above terms in the present application are based on specific circumstances.

[0024] The following will specially describe the embodiments of the present application, examples of which are shown in the accompanying drawings, where identical or similar label

represent identical or similar components or components with identical or similar functions. The embodiments described below with reference to the accompanying drawings are illustrative and merely intended to explain the present application, which cannot be understood as limitations to the present application.

5 **[0025]** The diesel oxidation catalysis (DOC) technology for particulate is to coat precious metal catalysts (e.g., Pt) on honeycomb ceramic substrates, which aims to reduce the chemical reaction activation energy of HC, CO, and SOF in the engine exhaust, so that these substances can be oxidized with oxygen in the exhaust gas at a low temperature and ultimately be converted into CO₂ and H₂O.

10 **[0026]** The DPF filters and captures particles in the engine exhaust mainly through diffusion, deposition, and impact mechanisms. When the exhaust gas flows through the DPF, particles are captured in the filter element of the filter, and the remaining cleaner exhaust gas is emitted into the atmosphere. The operation principle of DPF is that, when the engine exhaust flows through the DOC, at a temperature of 200 to 600°C, CO and HC are almost completely
15 oxidized into CO₂ and H₂O, and NO is converted into NO₂. When the exhaust gas enters the DPF from the DOC, the particles are captured in the filter element of the filter, and the remaining cleaner exhaust gas is discharged into the atmosphere. The capture efficiency of the DPF can reach over 90%.

20 **[0027]** The exhaust particulate of an engine mainly includes two components: unburned soot and ash, with the majority of particulate emissions being composed of small particles of carbon and carbides. More and more particulates accumulate on the DPF over time, which not only affects the filtering effect of the DPF, but also increases the exhaust back pressure, thereby affecting the gas exchange and the combustion of the engine, resulting in decrease in power output and increase in fuel consumption. Therefore, how to timely remove particulates
25 from the DPF (DPF regeneration) is the key to this technology.

[0028] The DPF regeneration refers to restoration of the filtration performance of the DPF by removing the deposited particulates regularly which are increasing in the DPF in long-term operation of the DPF to cause increase in engine back pressure and decrease in engine performance. The DPF regeneration includes active regeneration and passive regeneration.

30 **[0029]** The active regeneration refers to the use of external energy to increase the temperature inside the DPF, causing particulates to be ignited and burned. Usually, when the

pressure difference sensors before and after the DPF detect that the back pressure across the DPF is too high, it is considered that the accumulation amount of carbon that the DPF can carry has been reached. At this time, external energy is supplied, for example, injection and combustion of diesel in front of the DOC, to increase the temperature inside the DPF, so that the temperature inside the DPF reaches a certain temperature. In that case, the deposited particles will be oxidized and burned, achieving the purpose of regeneration. The temperature of the DPF rises above 550°C, which causes the captured particles to burn, thereby restoring the capture ability of the DPF. Fuel may be injected through the CH injection system, or diesel may be injected through the post injection of the engine or a separate fuel injection nozzle, allowing soot to react with O₂ in a high temperature environment (above 500°C).

[0030] A passive regeneration refers that, since NO₂ in the exhaust gas has strong oxidation ability to the captured particles within a certain temperature range, NO₂ can be used as an oxidant to remove particles from the particulate filter and generate CO₂ while NO₂ is then reduced to NO, achieving the purpose of removing particles. The occurrence of passive regeneration does not require additional fuel. Therefore, during the life cycle of DPF, the more times the passive regeneration is implemented, the longer the needed active regeneration cycle is, and the less fuel is consumed by the post-processing system, thereby reducing the overall fuel consumption of the engine. A request for passive regeneration can be sent by a vehicle controller, which can evaluate whether the passive regeneration request is triggered based on its own control program. The vehicle controller can send the passive regeneration request to a controller used to execute the control method of the exhaust post-processing device in this embodiment. The triggering conditions for the passive regeneration request are known in related technologies, for example, disclosed in the prior patent Application with publication No. CN110985222A.

[0031] As shown in FIG. 1, an exhaust post-processing device is provided in an embodiment, which includes a first processing device, a second processing device, a bypass pipeline 7, and a control valve 8. Along the flow direction of the exhaust gas, the second processing device is located upstream of the first processing device.

[0032] The first processing device includes a first DOC 1, a DPF 2, and a first SCR 3 sequentially arranged in the exhaust pipeline along the flow direction of the exhaust gas, and the second processing device includes a second DOC 5 and a second SCR 6 sequentially

arranged in the exhaust pipeline along the flow direction of the exhaust gas. The first end of bypass pipeline 7 is in communication with an input end of the second DOC 5, and the second end of bypass pipeline 7 is in communication with an output end of the second SCR 6. The control valve 8 is used to control connection or disconnection of the bypass pipeline 7. In the exhaust post-processing device provided in this embodiment, the control valve 8 is opened to bypass the second processing device when a passive regeneration request is made. It can reduce heat loss of the exhaust gas caused by flowing through the second processing device and can increase the temperature at the input end of the first DOC 1 and increase the content of NO₂ entering the DPF 2. When the temperature at the input end of the DPF 2 increases to the required temperature, it can effectively improve the passive regeneration rate, effectively balance the carbon load, extend the active regeneration cycle, and improve the user's work efficiency. Meanwhile, the efficiency of the first SCR 3 increases at the high temperature, and the emission can be effectively ensured by increasing the urea supply to the first SCR 3.

[0033] Optionally, the exhaust post-processing device may further include a first urea injection device (not shown) and a second urea injection device (not shown). The first urea injection device is used to feed urea into the first SCR 3 and the second urea injection device is used to feed urea into the second SCR 6. When there is no regeneration request, the control valve 8 is shut off, and the exhaust gas flows through the second processing device and the first processing device in sequence. Urea is fed to the first SCR 3 through the first urea injection device, and urea is fed to the second SCR 6 through the second urea injection device, which is conducive to the conversion of NO_x without high NO_x leakage.

[0034] Optionally, the first processing device may further include an ammonia slip catalyst (ASC) 4 located downstream of the first SCR 3 along the flow direction of the exhaust gas. The main function of the ASC 4 is to eliminate an excessive or escaped NH₃, specifically, oxidize the excessive NH₃ into N₂, N₂O, NO_x, and catalyze the reaction of NO_x and NH₃ to generate nitrogen N₂.

[0035] Optionally, the exhaust post-processing device may further include a first temperature sensor for detecting the temperature at the input end of the first DOC 1, a flow sensor for detecting the flow rate of exhaust gas at the input end of the first DOC 1, and a second temperature sensor for detecting the temperature at the input end of the DPF 2.

[0036] A control method of the exhaust post-processing device is further provided in an

embodiment, which is performed by the aforementioned exhaust post-processing device.

[0037] Exemplarily, as shown in FIG. 2, the control method of the exhaust post-processing device includes the following steps.

[0038] S100: determine if a passive regeneration request is received.

5 **[0039]** When a passive regeneration request is triggered, the vehicle controller can send the passive regeneration request to a controller used to execute the control method of the exhaust post-processing device.

[0040] If the passive regeneration request is received, proceed to S200, and if no passive regeneration request is received, proceed to S400.

10 **[0041]** S200: open the control valve 8.

[0042] S300: conduct a thermal management by the first processing device.

[0043] When the control valve 8 is opened, the second processing device is bypassed, which can reduce the heat loss of the exhaust gas caused by flowing through the second processing device. Meanwhile, it can increase the temperature at the input end of the first DOC 1 and the
15 content of NO₂ entering the DPF 2, which is beneficial for improving the passive regeneration rate.

[0044] Optionally, as shown in FIG. 3, S300 may include the following steps S310 to S392.

[0045] S310: obtain the temperature at the input end of the first DOC 1.

[0046] The temperature of the input terminal of the first DOC 1 may be detected by the first
20 temperature sensor.

[0047] S320: determine if the temperature at the input end of the first DOC 1 exceeds the set temperature.

[0048] When the temperature at the input end of the first DOC 1 exceeds the set temperature, it indicates that the ignition temperature of the HC is reached. The value of the set
25 temperature can be set according to the actual need. In this embodiment, the set temperature is exemplarily set to 280°C. When the temperature at the input end of the first DOC 1 does not exceed the set temperature, the temperature at the input end of the first DOC 1 may be increased by at least one of the following methods: reducing the opening degree of the intake throttle valve of the engine, fuel post injection, etc.

[0049] S330: obtain the flow rate of the exhaust gas flowing through the first DOC 1.

[0050] The flow rate of exhaust gas at the input end of the first DOC 1 may be detected by a flow sensor.

[0051] S340: obtain the temperature at the input end of the DPF 2.

5 **[0052]** The temperature at the input end of the DPF 2 may be detected by the second temperature sensor.

[0053] S350: determine the feedforward fuel quantity based on the temperature at the input end of the first DOC 1 and the flow rate of exhaust gas at the first DOC 1.

[0054] In S350, the feedforward fuel quantity may be determined by the following formula:

10 **[0055]** $Q = \text{flow rate of exhaust gas in the first DOC 1} * \text{hot melt of the exhaust gas} * (\text{set value of regeneration temperature} - \text{temperature at the input end of the first DOC 1})$, and

[0056] feedforward fuel quantity = $Q / \text{calorific value} / \text{conversion efficiency of HC in the first DOC 1}$,

[0057] where, Q represents quantity of heat, and the set value of regeneration temperature, 15 calorific value, and conversion efficiency of HC in the first DOC 1 are all constants. The set value of regeneration temperature may be determined according to the engine model, the calorific value may be determined according to the fuel product, and the conversion efficiency of HC in the first DOC 1 may be set according to the engine model. The hot melt of the exhaust gas may be determined based on the temperature at the input end of the first DOC 1. 20 Exemplarily, a first relationship map between the temperature at the input end of the first DOC 1 and the hot melt of the exhaust gas may be pre-stored in the controller, and the corresponding hot melt of the exhaust gas may be searched out from the first relationship map based on the temperature at the input end of the first DOC 1. This first relationship map may be obtained through extensive preliminary experiments.

25 **[0058]** S360: determine a corrected fuel quantity based on the temperature at the input end of the first DOC 1, the flow rate of exhaust gas in the first DOC 1, and the temperature at the input end of the DPF 2.

[0059] Exemplarily, S360 includes the following steps S3601 to S3603.

[0060] S3601: determine the upstream set temperature of the DPF 2 based on the

temperature at the input end of the first DOC 1 and the flow rate of exhaust gas in the first DOC 1.

[0061] Exemplarily, a map for the temperature at the input end of the first DOC 1, the flow rate of exhaust gas in the first DOC 1, and the upstream set temperature of the DPF 2 is pre-stored in the controller. The corresponding upstream set temperature of the DPF 2 may be looked up from this map based on the temperature at the input end of the first DOC 1 and the flow rate of exhaust gas in the first DOC 1. This map can be obtained through extensive preliminary experiments. When all components of the exhaust post-processing device are able to work normally, the detected temperature at the input end of the DPF 2 is the same as the upstream set temperature of the DPF 2. As the exhaust post-processing device has been used over time, the performance of each component decreases, which leads to a difference between the detected temperature at the input end of the DPF 2 and the upstream set temperature of the DPF 2, and thus a difference between the feedforward fuel quantity and the actual demand.

[0062] S3602: calculate the difference between the upstream set temperature of the DPF 2 and the temperature at the input end of the DPF 2.

[0063] S3603: determine the corrected fuel quantity based on the difference.

[0064] Exemplarily, a second relationship map between the difference and the corrected fuel quantity is stored in the controller in advance. The corresponding corrected fuel quantity can be searched out from the second relationship map based on the difference. The second relationship map may be obtained through extensive preliminary experiments.

[0065] S370: calculate the total fuel quantity, which is equal to the sum of the feedforward fuel quantity and the corrected fuel quantity.

[0066] The step S370 can correct the feedforward fuel quantity by the corrected fuel quantity, so that the total fuel quantity can match with the current working state of the exhaust post-processing device.

[0067] S380: compare the total fuel quantity with the set fuel quantity.

[0068] If the total fuel quantity is less than the set fuel quantity, proceed to S391; and if the total fuel quantity is not less than the set fuel quantity, proceed to S392.

[0069] S391: use the total fuel quantity as the regeneration fuel injection quantity.

[0070] S392: use the set fuel quantity as the regeneration fuel injection quantity.

[0071] Through steps S380 to S392, the regeneration fuel injection quantity can be determined based on a smaller value of the total fuel quantity and the set fuel quantity. The set fuel quantity is the maximum fuel quantity that the injector can inject, which can prevent the
5 total fuel quantity from exceeding the maximum allowable limit of the injector. When determining the amount of the regenerative fuel injection, fuel can be fed through the engine post injection or through the HC injection system, and the amount of the fed fuel is equal to the amount of the regenerative fuel injection. The engine post injection or the HC injection system are both known in the related technologies, which are two different ways of feeding
10 fuel to the exhaust post-processing device.

[0072] S400: keep the control valve 8 closed and repeat step S100.

[0073] A vehicle is further provided in an embodiment, which includes the exhaust post-processing device in the above technical solution.

CLAIMS

1. An exhaust post-processing device, comprising a first processing device, a second processing device, a bypass pipeline (7), and a control valve (8), wherein

5 the first processing device comprises a first diesel oxidation catalyst DOC (1), a diesel particulate filter DPF (2), and a first selective catalytic reduction SCR (3) sequentially arranged in an exhaust pipeline in a flow direction of an exhaust gas,

the second processing device is arranged upstream of the first processing device and comprises a second DOC (5) and a second SCR (6) sequentially arranged in the exhaust
10 pipeline along the flow direction of the exhaust gas,

the bypass pipeline (7) has a first end being in communication with an input end of the second DOC (5), and a second end being in communication with an output end of the second SCR (6), and

the control valve (8) is configured to control connection or disconnection of the bypass
15 pipeline (7).

2. The exhaust post-processing device according to claim 1, further comprising a first urea injection device and a second urea injection device, wherein

the first urea injection device is configured to feed urea into the first SCR (3), and the
20 second urea injection device is configured to feed urea into the second SCR (6).

3. The exhaust post-processing device according to claim 1 or 2, further comprising:

a first temperature sensor for detecting a temperature at an input end of the first DOC
(1);

25 a flow sensor for detecting an flow rate of the exhaust gas at the input end of the first DOC (1); and

a second temperature sensor for detecting a temperature at an input end of the DPF (2).

4. A control method of the exhaust post-processing device according to any one of claims 1 to 3, comprising:

determining if a passive regeneration request is received;

opening the control valve (8) in response to a determination that the passive regeneration request is received; and

conducting a thermal management by the first processing device.

5. The control method according to claim 4, wherein the step of conducting the thermal management by the first processing device comprises:

obtaining a temperature at an input end of the first DOC (1);

determining that the temperature at the input end of the first DOC (1) exceeds a set temperature;

obtaining a flow rate of the exhaust gas flowing through the first DOC (1);

obtaining the temperature at an input end of the DPF (2);

determining a feedforward fuel quantity based on the temperature at the input end of the first DOC (1) and the flow rate of the exhaust gas flowing through the first DOC (2);

determining a corrected fuel quantity based on the temperature at the input end of the first DOC (1), the flow rate of the exhaust gas flowing through the first DOC (1), and the temperature at the input end of the DPF (2);

calculating a total fuel quantity equal to a sum of the feedforward fuel quantity and the corrected fuel quantity;

comparing the total fuel quantity with a set fuel quantity; and

assigning the total fuel quantity to a regeneration fuel injection quantity in response to a comparison that the total fuel quantity is less than the set fuel quantity.

6. The control method according to claim 5, wherein the step of conducting the thermal management by the first processing device further comprises:

assigning the set fuel quantity to the regeneration fuel injection quantity in response to a comparison that the total fuel quantity is not less than the set fuel quantity.

7. The control method according to claim 5, wherein the step of determining the feedforward fuel quantity based on the temperature at the input end of the first DOC (1) and the flow rate of the exhaust gas flowing through the first DOC (2) comprises:

Q = the flow rate of the exhaust gas flowing through the first DOC * hot melt of the exhaust gas * (a set value of a regeneration temperature – the temperature at the input end of the first DOC), and

the feedforward fuel quantity = Q /a calorific value/a conversion efficiency of HC in the first DOC,

where, Q represents quantity of heat, and the set value of the regeneration temperature, the calorific value, and the conversion efficiency of HC in the first DOC (1) are all constants, and the hot melt of the exhaust gas is determined based on the temperature at the input end of the first DOC (1).

8. The control method according to claim 5, wherein the step of determining the corrected fuel quantity based on the temperature at the input end of the first DOC (1), the flow rate of the exhaust gas flowing through the first DOC (1), and the temperature at the input end of the DPF (2) comprises:

determining an upstream set temperature of the DPF (2) based on the temperature at the input end of the first DOC (1) and the flow rate of the exhaust gas flowing through the first DOC (1),;

calculating a difference between the upstream set temperature of the DPF (2) and the temperature at the input end of the DPF (2); and

determining the corrected fuel quantity based on the difference.

9. The control method according to claim 4, further comprising:

keeping the control valve (8) closed in response to a determination that the passive regeneration request is not received.

10. A vehicle, comprising the exhaust post-processing device according to any one of
5 claims 1 to 3.