Study on the Application of Catalytic Combustion Furnace of Natural Gas for Heating Pottery and Purification of Pottery to Water

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ABSTRACT

This article discussed the application of the catalytic combustion furnace based on the combustion of lean natural gas-air mixtures in catalytic honeycomb monoliths for heating pottery and purification of pottery to water by means of theory and experiments. It was found that the pottery heated by the catalytic combustion furnace were more fine and glossy than that of conventional ones. The river water in experimental group was put in pottery. On the contrary, the river water in control group was put in porcelain. Put the same amount of water in pottery and porcelain respectively for three days. The result showed that the river water in experimental group is more transparent than that in control group.

INTRODUCTION

Rivers not only supply a large amount of surface freshwater accessible for human consumption but also play an important role in maintaining regional ecological and environmental functions such as hydrological cycle and agricultural irrigation among others. However, due to anthropogenic activities and climate change, numerous rivers throughout the world have shrunk or disappeared in recent decades, and others have also faced severe water quality problems. Over the past several decades, water quality problems has gradually become an issue to the environment management. With the rapid development of industry and economy, a large number of industrial wastewater containing toxic and harmful substances is untreated and discharged into natural water directly or indirectly, causing the pollution of drinking water sources and increasingly serious, which leads to the deterioration of water quality of drinking water. Water pollution is a critical environmental issue for the
world, which is also a global problem with far-reaching impacts to human health. The conventional water purification process depends on drug delivery, ignoring healthy of people.

Because of the great interest in characteristics which purification of pottery to water, many research was conducted. The law of water absorption of the pottery has been demonstrated in 2004, the conclusion could be reached that the ultimate load and water are better than those of Ming dynasty. Turbidity of source water may be principal indicator in characterizing the filter's lifetime in terms of water production capacity. A flow rate study was conducted by creating four controlled scenarios with different turbidities, and influent and effluent water samples were tested for total suspended solids and particle size distribution. To better understand the purification of pottery to water, this paper discussed the application of the pottery heated by the natural gas catalytic combustion furnace. On the basis of experiment and data analysis, it was preliminarily proved that pottery has the obvious effect of water purification.

**EXPERIMENTAL SET-UP**

Figure 1 illustrates the system diagram of catalytic combustion furnace. The furnace body had a cubical shape, whose edges were 500 mm long, 500 mm wide and 660 mm high. It was connected to the catalytic burner. The support for all the monoliths tested here was cordierite and its softening temperature was 1380°C. The two square catalytic honeycomb monoliths were installed in the burner each time. The square honeycomb monoliths were 150 mm wide and 20 mm long, with square-shaped cells which sectional area was 1mm×1mm. In order to decrease the temperature of mixtures in chamber connected with the monolith’s entrance, the 20mm long blank monoliths were inserted between the chamber and the Pd based catalytic monolith’s entrance as assembly of monolith. The reactant gas feeds of natural gas and air were regulated via GMS0050BSRN200000 natural gas meter and CMG400A080100000 air meter with 0~50 L/min and 0~80 m³/h of full-scale ranges, respectively. The two meters were provided by electric current. The cooling circulating water was used to cool the burner chamber.
Figure 1. The system diagram of catalytic combustion furnace.

Figure 2 shows the pottery heated by the catalytic combustion furnace. The pottery possessed soft color and smooth surface. With delicate and exquisite appearance, it created superb decorative effect and high artistic, which drew much admiration of the people.

Figure 2. pottery heated by the catalytic combustion furnace.

THE APPLICATION OF THE POTTERY

Experimental samples

The pottery heated by the catalytic combustion furnace was used in the experimental group. Its appearance was regular and cylindrical, and the surface is brick red. By comparison, the white glaze porcelain was in control group. The water used in the experiment came from a river in Beijing.
Experimental design

Turbidity test instrument of the river: Shanghai Xin Rui instrument and Meter Co., Ltd (WGZ-200A Turbidity meter). WGZ-200A Turbidity meter was used to measure the scattering of light produced by insoluble particulate matter suspended in water or in a transparent liquid, and quantitative identification the content of these suspended particulate matter. NTU is used as turbidity measurement unit. Before experiment, the zero turbidity water sample bottle into the specimen holder was installed, and ensure the cross scale vertical alignment white sample bottle positioning line sample seat, and then covered with a shading cover, this operation was defined as zeroing operation. After the operation was completed, the turbidity of the sample can be determined. The instrument working environment temperature: 5-40 degrees Celsius. The instrument placed on a smooth and steady experimental table was effective in avoiding direct light. Figure 3 shows the instrument.

Be ready pottery and porcelain and Wahaha pure water, and rinse the two containers with pure Wahaha water. Wiping the traces of water and fingerprints on the sample bottles with good absorption to water and no dropping hair tissue or a soft cloth, the 200ml river water samples were placed in the pottery and porcelain, seal, in the same environment for three days. After treatment, taking 200ml samples of River Water in pottery and porcelain for sealing treatment, and placed in the same environment for three days, which means pottery was used as the experimental group and porcelain as the control group. After a-three day experiment, the result showed change of turbidity between two groups. Sequentially, the experiments were done for another two times during the period of one month.
Test results and discussion

The samples of river water taken were shown in Fig. 5. Three days later, the water samples in pottery and porcelain were shown in Fig. 6. In order to compare with the control group, the pottery in the water was poured into the white glaze porcelain. The turbidity change of the river water samples in the experimental group and the control group was observed in Fig. 6. Fig. 6 plots the curves of turbidity of the water samples pottery and porcelain, respectively.

As we can see, in contrast to the raw water, the water samples in pottery and porcelain are all clear and transparent. Sequentially, we can conclude some conclusions as follows by comparing the samples in the analysis of pottery and porcelain, there is relatively little impurity in the water sample of pottery, and the quality of water is more clear and transparent, while the water sample in porcelain has more impurities by eyes. The turbidity of the water taken from the river is 6.04 NTU. Through the experimental measurement.

Figure 5. The samples of river water. Figure 6. The samples in pottery (left), The samples of river water (right).

Figure 6 (a) Curves of turbidity of the water samples in pottery
(b) Curves of turbidity of the water samples in porcelain.
Obviously, great change in the turbidity of the water samples in the pottery took place in the beginning varying from 1.7NTU to 2NTU, in the next ten minutes, the turbidity tended to be stabilized at about 1.7NTU in the next ten minutes. The turbidity began to rise slightly about 4.25NTU. For the next 20 minutes or so, the turbidity stabilized at 4.5NTU.

As can be seen from the graph, the turbidity of water samples is lower than the turbidity of raw water samples in pottery and porcelain. In contrast, the turbidity of water samples in pottery is more obvious in reduction. So it can be concluded that the catalytic combustion furnace pottery has reduced the turbidity of water preliminarily.

CONCLUSIONS

It was found that the glazed pottery products heated by the catalytic combustion furnace are glittering and translucent than that of conventional ones. At the same time, the blank was combined with glaze very well, and they were all blend into one harmonious whole.

Besides, the purification of pottery to water including turbidity and transparency was also discussed by means of comparison. The water samples in the experimental group were cleaner and more transparent than that in control group. The turbidity and transparency of the water samples in pottery heated by the catalytic combustion furnace decreased obviously. Without drug delivery, the pottery heated by the catalytic combustion furnace could be applied to the purification of water in river in the consideration of human health. It indicated the advantages of pottery heated by the catalytic combustion furnace. Catalytic combustion furnace played an increasingly important role for improving health of human beings in water purification.

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REFERENCES


