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Optimization of planting concrete materials with nitrogen and phosphorus removal characteristic

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Abstract: The adsorption performance of zeolite, steel slag and gravel on the nitrogen and phosphorus was studied in this paper, and the best aggregate of concrete with high efficiency and nitrogen removal was optimized; Through dynamic experiments to investigate the formation of white clover, Bermuda grass, Bahia grass and best aggregate combination planting concrete on the removal of ammonia nitrogen, total phosphorus, and optimized high efficiency removal of nitrogen and phosphorus removal of concrete. The result shows that in the ammonia nitrogen and total phosphorus concentration of 20mg/L and 5mg/L, the adsorption capacity of zeolite to ammonia nitrogen was significantly better than that of steel slag and gravel, while the difference between the three is not obvious, the zeolite is the best aggregate for the production of high efficiency nitrogen and phosphorus removal; In the influence of ammonia nitrogen and total phosphorus concentration keeping 5mg / L and 1mg/L, Bahia grass effect on zeolite plant growing concrete removal of nitrogen and phosphorus removal system promoting effect was significantly higher than that of Bermuda grass and white clover. Zeolite and Bahia combinations can be used as the best combination of plants to produce efficient nitrogen and phosphorus removal planting concrete aggregate.

1. optimization test of aggregate

The physical and chemical properties of aggregate as the main structural materials of the planting concrete will directly affect the purification performance of the concrete. In Fig.1, it can be found that the adsorption performance of different aggregate concrete blocks is different. The adsorption of ammonia nitrogen made by three kinds of materials was similar, and all of them showed the adsorption process from fast to slow and final saturation.

In Fig.2, the experimental results show that the aggregate adsorption capacity of three kinds of aggregate planting concrete blocks is ranked as steel slag, zeolite and gravel, and the saturated adsorption capacity is 51.30mg, 48.28mg and 47.67mg respectively.



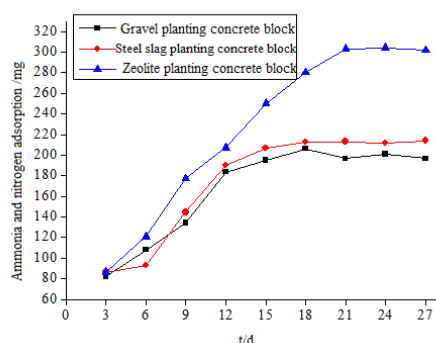


Figure 1. changes of ammonia nitrogen adsorption over time

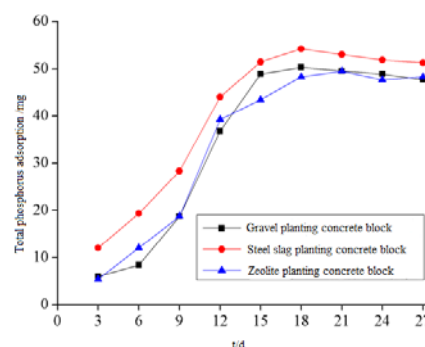


Figure 2. changes of total phosphorus adsorption over time

The adsorption capacity of zeolite to ammonia-nitrogen was better than that of steel slag and gravel in the optimization experiment of porous concrete materials with nitrogen and phosphorus adsorption characteristics by Zhang Zhengke and Guo Qingwei. The adsorption capacity of steel slag to water is better than that of zeolite by the isothermal adsorption test of Zhu Wentao and SiMa xiaofeng. But the pure aggregate is different from planting concrete block, the adsorption rate of nitrogen and phosphorus was obviously reduced, and the time needed to reach saturation was also greatly extended. However, the adsorptive capacity of plant concrete block to phosphorus in aqueous solution did not show significant difference in the adsorption of pure aggregate. This is because the aggregate after cement coated with the solution can not fully contact, reduced the adsorption capacity of nitrogen and phosphorus; release of cement on the hydration process of metal ions and oxides of wastewater and NH_4^+ , HPO_4^{2-} formed by reaction precipitation of insoluble, improve the ability of concrete block for nitrogen removal, phosphorus plant. Therefore, considering the effect of simultaneous removal of nitrogen and phosphorus from plant concrete, zeolite is the best aggregate for producing high efficiency denitrogenation and dephosphorizing concrete.

2. plant selection test

As can be seen in Fig.3, the change of ammonia nitrogen outflow concentration is stable after rising first. The concentration of ammonia nitrogen in the first three planted concrete in the first three years of 12d showed an increasing trend, followed by the decrease of the concentration of ammonia and nitrogen in the plant of zeolite, and the stability of about 21d. The effluent concentration of ammonia nitrogen in the root and white clover concrete of zeolite reached the maximum value at about 18d and reached a stable state at about 24d. From Fig.3 and Fig.4 shows that the best effect of Bahia grass planting concrete zeolite to remove ammonia nitrogen.

From Fig.6, it can be seen that the concentration of total phosphorus in the effluent is on the rise and then tends to be stable. After the adsorption and saturation of the aggregate, the phytogenic concrete mainly depends on the physical interception, plant root absorption and microbial action to remove the phosphorus in the wastewater. At 30d, the removal efficiency of the total phosphorus of zeolite bacilli was due to the other two planting concrete.

The ammonia nitrogen removal rate of three planting concrete and blank block 30d increased by 28.31%, 23.89%, 18.17% respectively. The removal rate of total phosphorus was increased by 14.64%, 10.69% and 5.09% respectively. Therefore, the zeolite Bahia grass planting concrete system for removing nitrogen and phosphorus effect was significantly higher than that of white clover and Bermudagrass.

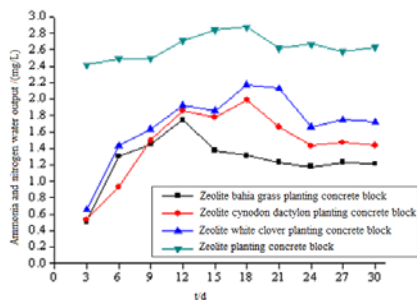


Figure 3. changes of ammonia concentration over time

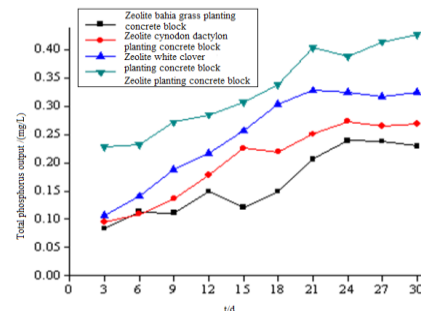


Figure 5. variation of total phosphorus effluent concentration over time

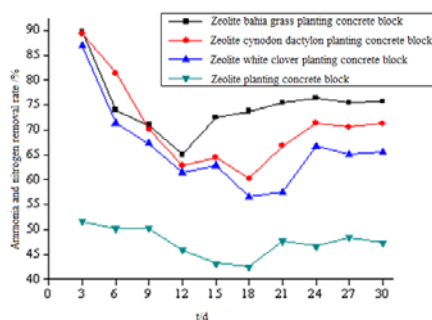


Figure 4. changes in ammonia removal rate over time

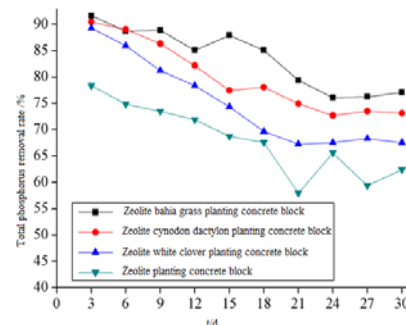


Figure 6. changes of total phosphorus removal rate over time

3. conclusion

Static adsorption test results show that the zeolite produced planting concrete block of ammonia nitrogen adsorption effect is superior to the steel slag and gravel planting concrete block. Zeolite produced planting concrete block of ammonia nitrogen adsorption performance is superior to steel slag and zeolite, and three kinds of material made of blocks of total phosphorus adsorption performance are different but the difference is not obvious. In order to give consideration to the effect of nitrogen removal and phosphorus removal efficiency, zeolite can be used as the best aggregates for high efficiency denitrification and phosphorus removal.

Dynamic test results show that zeolite Bahia grass planting concrete removal effect of nitrogen and phosphorus in promoting effect is better than that of Bermuda grass and white clover.

Aggregate optimization experiment and plant optimization results show that the zeolite and bahia grass combination to make efficient denitrification and phosphorus removal of vegetation concrete aggregate and plant the best combination.

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