

Effects of different carbon and nitrogen ratio on the quantity of nitrogen cycle bacteria in the landfill unit

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Abstract: Landfill cell microbial carbon metabolism is not only organically influenced by the impact of landfill unit, but also closely related to the levels of landfill unit nitrogen. In this paper, we regard the landfill layer which is landfill in the surrounding black soil of Jilin Agricultural University as the research subjects, and we use laboratory experiments to comparative and study four kinds of nitrogen treatment (natural state carbon nitrogen ratio which is not adjusted, carbon and nitrogen ratio of 5: 1, carbon nitrogen ratio 20: 1 carbon nitrogen ratio: 50: 1) which are used to collect samples periodically. Using MPN measured the number of microorganisms of the unit of landfill and studying different carbon nitrogen ratio ratio of landfill unit ammonifiers affect the activity of denitrifying bacteria. Experimental results show: (1) Different carbon nitrogen ratio has different influence on the number of denitrifying bacteria and ammonifiers in the unit of the landfill. The number of ammonifiers, nitrobacteria and denitrifying bacteria is large of low carbon nitrogen ratio landfill, but high carbon nitrogen ratio is opposite. (2) Over time, different carbon nitrogen ratio changed the number of ammonifiers, nitrobacteria and denitrifying bacteria of the unit of the landfill which showed the trend of the first increase and then decrease. From this, we know the number of ammonifiers, nitrobacteria and denitrifying bacteria of the unit of the landfill is related to the ratio of carbon and nitrogen of the unit of the landfill.

Leachate is a high-concentration waste which is produced and exist in the landfill unit during the process of the landfill, which is harmful, improper handling can cause soil and water pollution and the impact on the environment, especially ammonia is one of the major harmful substances which is more intractable. Currently using nitrification / denitrification as the core of biological treatment at the time of treatment of landfill leachate is the most cost-effective method. According to normal conditions the landfill unit ammoniated process is the main source of ammonia and part ammonia involved in the nitrification process to produce nitrate nitrogen. Finally denitrifying bacteria utilize organic as electron donor, and nitrate respiration as electron acceptor, then reduced it to N₂O, N₂, and nitrobacteria and denitrifying bacteria is the main principle of nitrogen degradation process. In this experiment, study the mechanism of action from the number of the main microbial of landfill unit nitrogen cycle that ammonifiers, nitrobacteria and denitrifying bacteria, essentially explain variation of bacteria in landfill unit nitrogen cycle. Now domestic and international research pay more attention to the aspects of harmful substances in landfill leachate, but combined effects of nitrogen levels and organic carbon levels on landfill unit microorganisms of landfill unit is still rarely reported. The experimental simulation of landfill process, by adjusting the ratio of different carbon and nitrogen microbial metabolism, affecting the amount variation of microbes. The landfill unit is adjusted into high, medium and low (50: 1, 20: 1, 5: 1), three different carbon nitrogen ratio of the landfill cell, and regularly measured the number of the bacterial in nitrogen cycle to explore the influence and the laws of the high, medium and low carbon-nitrogen ratio on the number of ammonifiers, nitrobacteria denitrifying bacteria and the time goes on, the number of nitrobacteria and denitrifying bacteria of landfill unit under different carbon nitrogen ratio. In order to avoid the process of landfill leachate cause soil, water pollution and

provide the basis for biological nitrogen removal.

Materials and methods

The experimental materials

Experiments are conducted in the college of resources and environmental sciences of Jilin agricultural university. The tested soil is black soil which collected from the peripheral of jilin agricultural university . The Sampling depth is 10cm-30cm,A total of about 2000kg.Frozen in 4 °C below zero in the freezer for later use .The test for soil organic carbon content 0.6573%,total nitrogen content is 1.725g/kg.The organic carbon of andfil unit is 14.11g/kg.Total nitrogen content is 5.364g/kg.Selected garbage are Chinese cabbage and potatoes that purchased at the farmer's market.

design of experiment

The garbage was buried by plastic bottles (garbage landfill by using Chinese cabbage and potatoes).Training 2 months after adjusting the carbon nitrogen ratio of landfill unit ,Total set four processing: The first processing to make carbon nitrogen ratio adjustment landfill unit under the condition of nature; The second processing of the carbon nitrogen ratio is 5:1 of landfill unit; The third treatment for carbon and nitrogen ratio is 20:1 of landfill unit; The fourth treatment of the carbon and nitrogen is 50:1 of landfill unit. 6 repeat each processing. In the temperature of 25. C of the constant temperature box, every 28 t to determine the number of nitrogen cycle microbial.Observe the number of changes.

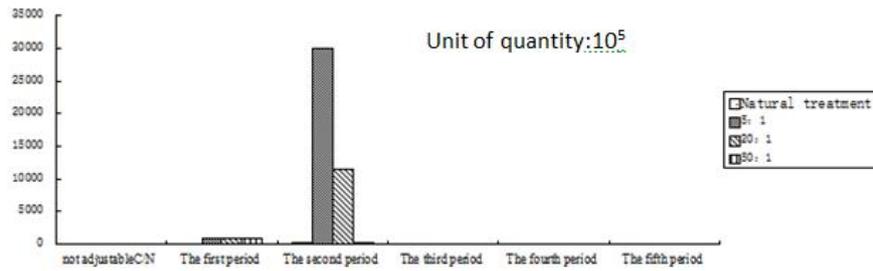
The quantity of nitrogen cycle bacteria in the landfill unit

Measuring the nitrogen cycle bacteria quantity of landfill unit By MPN method. Respectively made culture medium of ammonifying bacteria, nitrifying bacteria, denitrifying bacteria culture medium.Adjusting the PH.Take the 5 ml medium into the test tube and The duchenne fermentation tube inversion with denitrifying bacteria culture medium in vitro .Finally,combined with tampon.In 121. C the sterilization 30 min. Set aside.Each unit landfill soil sample does times dilution.Each test tube dilution soil samples 1 ml.Each dilution degrees do three parallel.Take 10g of unit of landfill soil specimens into 90 ml of sterile water.And then with a pipette dilution in turn into 10-2,10-3,10-4.....suspension.Take 1 ml of dilution soil sample into each test tube.Each dilution degrees to do three parallel.In the 28 ° C ,Ammonifying bacteria culture 7 d,Nitrifying bacteria, denitrifying bacteria culture of 14 d.Using Nessler's reagent, Griess reagent, Diphenylamine reagent for the creation and depletion of various forms of detection such as nitrogen.And regularly observation of denitrifying bacteria in duchenne fermentation of fermented tube, gas.At last check the MPN table.It is concluded that the number of bacteria in 1 ml of the sample.

The results and analysis

Different carbon and nitrogen ratio on the quantity of ammonifying bacteria in the landfill unit

The first step in the nitrogen mineralization is ammoniation, microorganisms play an important role in it.As can be seen from the figure 1, 28 t after adjusting the carbon and nitrogen ratio,After the first cycle,Measured the landfill of all processing unit of ammonifying bacteria number were increased significantly,but the nature of which is not adjustable carbon nitrogen ratio is controlled growth than other three groups deal with smaller growth. Number of ammonifying bacteria reached maximum and Ammonifying bacteria number of size are 5:1>20:1>50:1>natural control in the second period.In the third cycle ammoniation bacteria are dropped. From the time change rule,Different carbon and nitrogen ratio occurred on the processing of ammonifying bacteria at first increased after reduced with nitric oxide release reaction.



Comments :In the first period,he number of ammonifiers, of all the landfill unit are more than 1×10^8

Fig. 1 The change trend that the number of ammonifier bacteria in the different period

Table 1. The number of ammonifying bacteria in different periods

	Nature C/N	The first period	The second period	The third period	The fourth period	The fifth period
Natural treatment	1.4	6.5	140	4.5	0.65	0.3
5:1		>1000	30000	45	3	0.095
20:1		>1000	11500	15	1.15	0.7
50:1		>1000	150	6.5	0.75	0.45

Different carbon and nitrogen ratio on the quantity of nitrifying bacteria in the landfill unit

Nitrification is ammonia under the action of microorganisms for nitrate oxide process, Microbial ammonium nitrogen can be converted to nitrate, at the oxidation process, NH_4^+ through chemical provide energy for microbial oxidation can release, As shown in figure 2, after adjusting the carbon and nitrogen ratio, the first cycle in the units of various carbon and nitrogen landfill nitrifying bacteria quantity has increased. Nitrifying bacteria number dropped substantially in the second cycle. With the second cycle in a landfill unit ammonifying bacteria, denitrifying bacteria number increase or decrease in the opposite. Each cycle of nitrifying bacteria population increased after decreased first and then increased. In the same period, the units of different carbon and nitrogen ratio landfill basic of nitrifying bacteria quantity appears as $5:1 > 20:1 > 50:1$. But in the first cycle, the number of nitrifying bacteria in the 50:1 of landfill unit more than the 20:1 of the landfill unit.

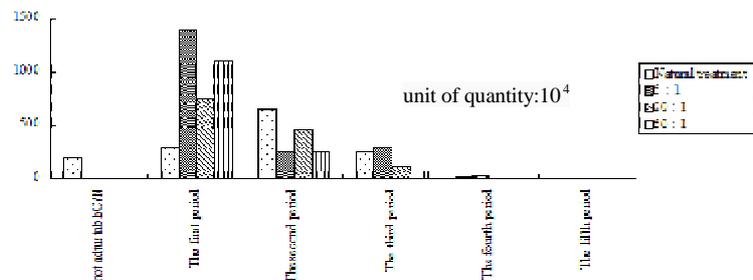


Fig. 2 The change trend that the number of Nitrifying bacteria in the different period

Table 2. The number of Nitrifying bacteria in different periods unit of quantity: 10^4

	Nature C/N	The first period	The second period	The third period	The fourth period	The fifth period
Natural treatment	200	300	650	250	11.5	0.45
5:1		1400	250	300	20	0.15
20:1		750	450	110	7.5	0.65
50:1		1100	250	75	1.15	0.45

Different carbon and nitrogen ratio on the quantity of denitrifying bacteria in the landfill unit

Denitrification reaction has a very important role in the nature. Denitrification reaction is an indispensable link in nitrogen cycle. Denitrifying bacteria will restore the nitrate. Release the N₂ or N₂O. As can be seen from the figure 3, After the first cycle, Adjusting the carbon and nitrogen ratio has increased the number of denitrifying bacteria. The carbon nitrogen ratio of 5:1 landfill unit in the largest number of denitrifying bacteria growth. In the first cycle and the second cycle landfill unit denitrifying bacteria number is on the rise and landfill unit of denitrifying bacteria number reaches the maximum value in the second cycle. Among the 5:1 of carbon and nitrogen ratio of the quantity of denitrifying bacteria in the landfill unit increase nearly 10 times. In the third cycle, The process of landfill unit quantity of denitrifying bacteria are began to decline, The quantity change trend and ammonifier quantity trends are basically identical.

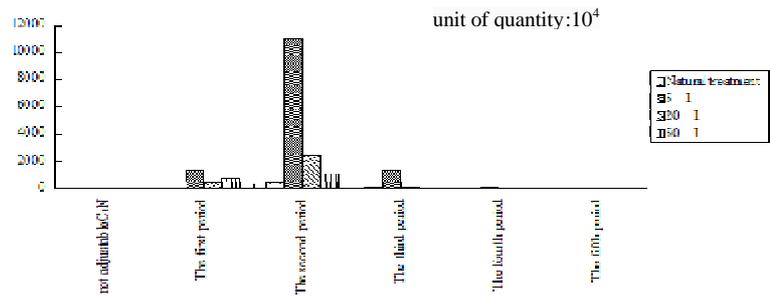


Fig. 3 The change trend that the number of denitrifying bacteria in the different period

Table 3. The number of denitrifying bacteria in different periods unit of quantity:10⁴

	Nature C/N	The first period	The second period	The third period	The fourth period	The fifth period
Natural treatment	1.6	11.5	450	110	7.5	3
5:1		1400	11000	1400	95	0.095
20:1		450	2500	110	2.5	0.14
50:1		750	1100	14	0.45	0.02

Discussion and Conclusions

Different carbon nitrogen ratio can affect the composition of the organic matter in the landfill unite and change the circulation of organic in the microorganism food chain , thus affecting the amount of microorganisms of landfill unite. The study found that in different carbon nitrogen ratio landfill unite at the same period ,with the carbon nitrogen ratio increasing the number of ammonifiers ,nitrobacteria ,denitrifying bacteria decrease. That is to say, the content of landfill unit organic carbon is higher, the number of ammonifiers and denitrifying bacteria is lower. From the time variation , with different carbon nitrogen ratio have both show that the number of ammonifiers and denitrifying bacteria increased first and then decreased, finally trends converge. The number of nitrobacteria at first increased and then decreased and increase again. The possible reasons: 1. low-carbon-nitrogen ratio of landfill unit that is present experiment N ratio of 5: 1 landfill unit facilitates microbial the release of nutrients in organic matter decomposition process ,the landfill unit available nitrogen increase; High carbon nitrogen ratio of landfill unit that is 50:1 carbon nitrogen ratio in this experiment landfill unit microbial decomposition of organic matter in the process will be nitrogen limited, reducing the number of microorganisms. So low carbon-nitrogen ratio of the number of microorganisms landfill unit carbon nitrogen ratio higher than the number of microorganisms landfill unit. 2. producing more leachate during the second period, the landfill unite is formed anaerobic conditions, and denitrifying bacteria are aerobic bacteria, therefore the number of bacteria nitrification decrease.

In summary, different carbon nitrogen ratio has great influence on the number of ammonifiers ,nitrobacteria and denitrifying bacteria of landfill unite . In this experiment, we measured the number of ammonifiers and denitrifying bacteria by MPN , but measurement period is long, can not be accurately measured the change of the number of ammonifiers, denitrifying

bacteria in each period. Therefore, we need further experiments and discussion.

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