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Sewage Sludge Aerobic Composting Technology Research Progress

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Abstract

This article introduced our country city sewage treatment plant sludge status, as well as the city sewage treatment plant slu dge aerobic composting technology research progress, and introduced the domestic production examples and problems, w hich can be used as a preliminary understanding of aerobic sludge composting techniques.

Keywords: Sewage sludge; Aerobic composting; Existing problems; research progress

1. Introduction

Statistical data shows, in 2010 China's sewage treatment capacity will reach 60000000 tons / day, sewage treatment plant discharges moisture content 80% of sludge volume reached 30000000 tons[1], with the development of economy, China's sewage treatment industry grows ceaselessly, the sludge produced about 10% per year to increase the proportion of. As a result of sludge disposal technology development lag, making a large number of city sludge can pile up temporarily, cause a lot of big city appeared the phenomenon of the besieged city sludge and has begun to spread medium and small city, a large accumulation of sludge, not only occupy large tracts of land, and the harmful ingredients such as heavy metals, pathogens, parasites, and organic pollutants from a city environmental health one big social effects of pollution, and to the ecological environment has brought great hidden trouble of safety[2].

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Despite spending a large amount of manpower, material resources management of sewage, but the associated product of sewage treatment sludge is not sufficient and effective control, greatly offset the sewage treatment environmental protection significance, sludge outlet problem has become an urgent need to solve one of the major environmental problems.

2. Aerobic composting technology advantages

2.1. Aerobic composting technology principle.

Sludge aerobic composting is actually a process of sludge microbial fermentation process. In this process, sludge soluble small molecular compounds by microbial cell wall and cell membrane by microbial uptake and utilization. The insoluble organic matter is first attached to the microorganisms, by secreted extracellular enzyme decomposed into soluble small molecular substances, in into the microbial cells by using. Through the microbial synthesis and decomposition, the part is absorbed by the oxidation of organic matter into simple inorganic compounds, and provide life needed energy, the other part of the conversion of organic compounds synthesizing new cellular material, so that the microbial proliferation[3]. Aerobic compost using aerobic bacteria and oxygen, so that sludge fermentation temperature, it is the treatment and disposal of sludge of city is an economical and effective good method, can make the organic decomposition of harmful substances thoroughly, composting cycle short, small, good control and other advantages. It uses multiple subjects, using the microbial communities in a particular environment to the polyphase decomposition of organic matter, the sludge modified into stable humus, for fertile land or soil improvement. Bulleted lists may be included and should look like this

2.2. Aerobic composting process.

Composting process is usually divided into three stages. The first stage is the mesospheric phase, the second stage is the high temperature stage, and Third stage is the maturity stage. Mesospheric phase marks the end of the reactor temperature rose to 45 ℃ the high temperature phase oxygen consumption rate, high temperature, high volatile organic matter degradation rate high, smell very strong maturity stage, low temperature, oxygen consumption rate, low porosity increases, grow in quantity and stable humus. Aerobic composting innocuous to ensure that the stack temperature is higher than 55℃ maintains 5~7 days, in order to kill the ascarid eggs and Escherichia coli requirements[4]. Composting process mainly includes pretreatment, the main fermentation, after processing, storage etc.

2.3. The influence factors of aerobic composting.

Due to the sewage treatment plant sludge characteristics, high water content, organic matter content is not high, small porosity, high viscosity and so on, therefore using sewage sludge as raw materials composting, usually with leaves, sawdust, wood, straw, compost amendment, or with the city life rubbish compost. According to previous studies, aerobic composting processes of sewage sludge on main controlling factors are: feed moisture content, ventilation system, temperature, pH value, C/N, conditioner. Composting sludge mixed raw material requirements: moisture content 50% ~ 60%, pH 5 ~ 9, C / N is 25 ~ 35:1, organic matter content of 20%~80%, 12 ~ 60mm size[5].

2.4. Aerobic composting ofventilation is one of the important factors of success.

Ventilation is to provide continuous fermentation process in aerobic organisms need oxygen, while the accumulation layer due to microbial respiration releases carbon dioxide blowing out the replacement of

fresh air, two is the place too much water, the three is the regulation of temperature and dilution of odor, assure composting reaction to maximum speed. The composting process suitable oxygen concentration is 15%~20%, a minimum of not less than 8%[6]. Sludge compost system mainly has four kinds: natural ventilation, ventilation mode, regularly turning passive ventilation and forced ventilation.

3. The present application situation of aerobic composting

The composting process is relatively simple, slow development. In recent years, the research of sludge composting, made technical aspects and preliminary results

Guojian Li proved that our city sewage sludge composting treatment feasibility of sludge, in adding sawdust and coal cinder, the fermentation period of 12~15d, a buttress type cloth tube spacing suggested 2m. Pinjing He: and other reports of dewatered sewage sludge and city garbage compost mixture suitable mixture ratio is 26%~38% (wt); sewage sludge and sludge and garbage of city pipeline ratio is 30%~40% (wt). Yonghao Zhang established a digested sewage sludge composting stage intermittent harmless temperature time standard (50℃~2h)[7], and presents the ventilation and digestion of sewage sludge compost on average reaction rate function relation, and standards for the establishment of a new composting operation air control modes, in accordance with the harmless temperature time standard to adjust the volume, the material in the composting process meets the standard maximum volume for the control mode of the process gas, i.e. to process gas as composting process air control modes. Yanxia Li through the test calculation of sludge reactor body heat production and heat dissipation balance, the minimum sludge compost volume of 0.64m^3, in the right conditions, 5.8℃ above the ambient temperature can make smooth temperature sludge compost[5]. Chinese Academy of science, Chinese Academy of Sciences Institute of geography of the successful development of sludge compost compound fertilizer with high efficiency and low consumption and preparation technology.

Through the comparison of technology and economy, chose aerated static bin composting processes, the successful development of the time - temperature feedback control of ventilation technology, realize the compost temperature and ventilation control automation. Establishment of natural ventilation and forced ventilation combining composting process, high efficiency and low consumption, obvious efficacy. Through 30 rounds of sludge composting raw material proportioning optimization and process parameter optimization experiment, obtained a suitable amendment, feed ratio and process parameters. Conducted 14 compost maturity evaluation index of compost, that energy consumption is 3.95kwh / (t·d), up to or superior to that of the international similar process energy consumption level of kwh / (t·d)[6]. Yidong Yang believed that early ventilation can rapidly improve the reactor temperature, in order to make the reactor temperature is maintained at the optimum temperature, can use inverted stack and air volume, especially in the composting period, make a stack in the accumulation of heat through the moisture absorption, evaporation cooling to prevent the reactor temperature rise. And through experiment in the composting process should be smaller volume, generally maintained at 10~ 15m^3/(h·t) gas; medium generally adopts a large air quantity and were maintained at 20~25m^3 / (h·t); Later the air volume on sludge drying[7]. Tongbin Chen is obtained through experiments, the low proportion of pile body conditioning, heating, cooling rate is slower, and the pile temperature lower, or even less than the sludge composting required sterilization temperature[8]; a higher proportion of conditioning, stack temperature, cooling rate is rapider, high temperature and short duration; but such as adding an appropriate proportion of reflux composting of sludge, pile body can be in 50℃ above the continuous high temperature sterilization time required.

At present, domestic sludge aerobic composting treatment project is not much. At the end of 2002.10, Beijing city in the southern suburbs of Daxing District Pang Gezhuang sludge disposal field the formal completion, Gaobeidian sewage treatment plant of 160000t/d sludge. It is understood, can start on sludge

mechanical dewatering (after dehydration in the water about 80%), then drying and drying process, the moisture content to about 60%[5]. Then in the composting process, sludge microorganism bacteria will be basically eliminated, achieve agricultural standard; at the same time the sludge formed humus, the change of character for granular or powder, become a heat absorption, loose soil, water conservation function of organic fertilizer.

Shenzhen Wo Green fertilizer companies use Creek River sewage treatment plant sludge compost fermentation, producing compound fertilizer, fertilizer[7]. The western suburbs of Tangshan City sewage plant static composting has been carried out for 5~6 years in the production equipment in recent years have greatly improved, and the declaration of patent products. The fertile soil of the Shanxi biological Limited company's comprehensive utilization of sludge production of three-dimensional composite fertilizer project, the integrated use of the world's advanced biological high nitrogen source fermentation technology, the independent development of sludge solar biological aerobic fermentation system, effectively overcomes the problem of sludge softening and mildew, innovative use of sludge softening, passivity, thermal spraying granulation process, production of a highly efficient organic, inorganic, microbial composite fertilizer[8]. The expert group validation, this kind of compound fertilizer of nitrogen phosphorus and potassium nutrient organic matter total more than 10%, more than 55%, heavy metal content of less than Ministry of agriculture standards, is a kind of high efficient, safe new ecological fertilizer[9]. At the same time, this three-dimensional compound fertilizer prices and ammonium bicarbonate is similar, has broad market prospects.

4.Aerobic composting technology existence question and development direction

During the composting of sludge in the process of the following questions: nitrogen loss during composting of odor pollution serious, serious, pollutants detoxifying effect, long time of compost. According to the report, during organic waste composting process, nitrogen loss rates in the 16%~67% range[10], which is mainly on ammonia volatilization loss of form. The composting process of nitrogen loss in the compost odor diffusion at the same time, substantial nutrient loss, thereby allowing the composting of agricultural value reduction. And due to the lack of good odor control technology, a large amount of odor emission, environmental pollution is more serious; greatly reduce the composting technology of social acceptability. Therefore, the nitrogen losses is to limit the composting process of extensive promotion bottleneck, composting nitrogen protecting technology is becoming the research focus in the field of organic waste composting. Zeolite, aluminum sulfate and some microbial agents and other additives were used for the reduction of organic waste composting process in ammonia volatilization [11], but as a result of effect and cost constraints, has not been widely used. Therefore, nitrogen loss during composting sludge seriously is still an important problem needed to be solved. To solve this problem, first through optimizing composting required for a variety of conditions, such as C/N, ventilation conditions. Sludge compost for the best ratio of carbon to nitrogen shall be 20~30. C plus low nitrogen assimilation rate decreased, resulted in loss of nitrogen; C plus high due to nitrogen deficiency inhibit the growth of microorganisms, thereby delaying the time of compost maturity. Composting process is mainly aerobic microbial flora in effect, so the condition of oxygen supply on sewage sludge composting effect is very important. Practice shows that the natural ventilation, continuous mandatory ventilation and intermittent mandatory ventilation can achieve good effect of composting, but intermittent mandatory ventilation temperature had better, reactor temperature to maintain a higher level, instructions are not ventilated better, should have the best ventilation conditions (including gas, ventilation frequency, gap time etc.). In addition, the water content of sludge, conditioner and osteoporosis agent properties, pH value have great expansion space, therefore, to seek the best fermentation conditions should be decided the composting efficiency determinants. Secondly, through research and development economic efficiency, environmental potential pollution risk lower compost nitrogen protecting agent to reduce

the loss of nitrogen during the composting process, reduce the composting process of the environmental pollution, improve the composting of final product quality. Composting process of organic matter degradation humus substances can chelae heavy metal, reduce the bioavailability of heavy metals in the sludge itself, however, the nature of the composting process on immobilization of heavy metals in a very limited role, especially in the heavy metal content of the sludge is relatively high, the efficiency is low compared to detoxification. In addition, although during the composting process, present in the sludge in organic pollutants will be a large number of degradation, but as a result of composting time and process conditions, still have a lot of refractory organic pollutants residue in the composting products. Therefore, in the use of composting technology of sludge in the process, the need to further strengthen the nitrogen protecting measures, reducing nitrogen loss, improve the immobilization of heavy metals and organic pollutants degradation rate effect.

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