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de Ingeniería y Ciencias ambientales:
Investigación, desarrollo y práctica.

GRÁNULOS AEROBIOS PARA LA ELIMINACIÓN DE NITRÓGENO AMONIAL Y NITRATOS EN AGUAS RESIDUALES

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AEROBIC GRANULES FOR WASTEWATER AMMONIA NITROGEN
AND NITRATE REMOVAL

Abstract

For 203 days, the performance of an aerobic granules laboratory-scale reactor for the removal of COD, ammonia and nitrate under different conditions was evaluated. The experiment was divided in four stages: 1) initially aerobic for the formation of the granules (0.36 kgCOD/kgTSS·d); 2) aerobic/anoxic under a high organic load (0.43 kgCOD/kgTSS·d); 3) aerobic/anoxic under a low organic load (0.26 kgCOD/kgTSS·d) and 4) aerobic under a very low organic load (0.17 kgCOD/kgTSS·d). The results show that under higher organic loading rate and aerobic conditions (stage 1) a dissolved COD removal of 88% was obtained. Under organic loadings between 0.15 and 0.2 kgCOD/kgTSS·d (stage 2) the dissolved COD removal decreased near to 80%. The ammonia nitrogen removal resulted inversely proportional to the ammonia-loading rate. With loads close to 0.01 kgNH₄-N/m³·d, ammonium removal of approximately 90% was obtained and with loads near 0.04 kgNH₄-N/m³·d the nitrogen removal decreased to 10%. Under alternating aerobic/anoxic conditions, with organic loads from 0.26 and 0.43 kgCOD/kgTSS·d, complete denitrification without the addition of an external carbon source was not achieved.

Key Words: Aerobic granules, denitrification, nitrification, sequential airlift reactor.

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COMPORTAMENTO E DESEMPENHO DO PROCESSO REATOR BIOLÓGICO COM LEITO MÓVEL (MBBR) PARA A REMOÇÃO DA MATÉRIA ORGÂNICA E COMPOSTOS NITROGENADOS

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*BEHAVIOR AND PERFORMANCE OF THE MOVING BED BIOFILM
REACTOR (MBBR) PROCESS FOR ORGANIC MATTER AND
NITROGEN REMOVAL*

Abstract

The MBBR process is a recent development technology that incorporates the best characteristic of processes with growth of biomass in suspension and attached biomass (biofilm). The technology was initially developed in Norway, to improve the performance the acting and/or to increase the capacity of plants of already existing wastewater treatment plants, mainly composed by activated sludge, with the minimum of physical expansion of the biological reactor and, consequently, accomplishment of engineering civil works. Inside the biological reactor of the MBBR process, carries with high Specific Superficial Area are kept in suspension. The mixing promoted by the aeration system exposes the carries to the liquid mass in suspension and, consequently, the microorganisms are kept attached and also in suspension. Therefore, in a same volume of the biological reactor volume it is possible to maintain a larger amount of biomass, thereby adding a larger amount of substratum to biodegradation. The control parameters are the same applied to the activated sludge process. This technology is under investigation at the Experimental Center of Environmental Sanitation of the Federal University of Rio de Janeiro (CESA-UFRJ) in an experimental unit, with a population equivalent to 500 inhabitants. Thus, this paper... presents and discusses some concepts related to technology and also exposes the results achieved after investigate the MBBR under variations in its operating conditions. The carries used, containing 600 m²/ m³ Specific Surface Area, were introduced into the biological reactor in 20% of volume.

Key words: Attached Biomass, Domestic Wastewater Treatment, Moving Bed Biofilm Reactor, Organic Matter and Nitrogen Removal.

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REMOCIÓN DE ARSÉNICO DEL AGUA DE CONSUMO HUMANO CON FILTROS DE CLAVOS DE HIERRO, FIBRA COMERCIAL, GRAVA Y ARENA

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ARSENIC REMOVAL FROM DRINKING WATER WITH IRON SPIKES,
COMMERCIAL FIBER, GRAVEL AND SAND.

Abstract

This study evaluates the efficiency of arsenic removal using two commercial materials of iron nails and household commercial fiber filter on a bed of gravel and silica sand. Iron oxides formed and deposited on the sand are excellent adsorbents to remove arsenic in water as inorganic species, due to its high specific surface. The adsorption of each material was evaluated by continuous testing well water 0.11 mgAsL^{-1} .

The best arsenic removal efficiency was 95.45%, achieved commercial fiber oxidized with 2N hydrochloric acid, the operating time of the sand filter was 624 hours. The final concentration of arsenic was less than 0.025 mgL^{-1} value that complies with the Official Mexican Standard for human use and consumption NOM127-SSA1-1994. This study provides a friendly alternative for arsenic removal because of its economic operational simplicity and ease of use for people of low socio-economic development.

Key words: adsorption, arsenic, nails, fiber.

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APLICACIÓN DE TÉCNICAS DE BIOLOGÍA MOLECULAR PARA LA IDENTIFICACIÓN DE MICROORGANISMOS NITRIFICANTES Y DESNITRIFICANTES ADHERIDOS A ZEOLITAS NATURALES

*APPLICATION OF MOLECULAR BIOLOGY TECHNIQUES FOR THE
IDENTIFICATION OF MICROORGANISMS NITRIFYING AND
DENITRIFYING ATTACHED ON NATURAL ZEOLITE*

Abstract

This study identified microbial populations in nitrifying and denitrifying batch reactors using Chilean natural zeolite with different diameters for microbial support. The microbial populations were analyzed using molecular biology techniques: DGGE and FISH, founding that Gamaproteobacteria are the best adapted to the present nitrification and denitrification conditions. Nitrifying reactors showed similarity in their microbiological composition independent of the support size used, presenting all 80% of Gammaproteobacteria. However, the denitrifying reactors showed a big diversity, finding Bacteria and Archaea in different proportions depending of the diameter utilized. It is recommended DGGE and subsequent FISH analysis with specific probes to determine Gamaproteobacteria and Archaea species involved.

Key words: Denitrification; DGGE; FISH; Nitrification; Zeolite.

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ANÁLISIS TÉCNICO Y ECONÓMICO DEL PROCESO DE COAGULACIÓN CON CLORURO FÉRRICO PARA REMOVER ARSÉNICO DE AGUA SUBTERRÁNEA

TECHNICAL AND ECONOMICAL ANALYSIS OF COAGULATION WITH FERRIC CHLORIDE TO ARSENIC REMOVAL OF GROUNDWATER

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Abstract

Coagulation using ferric chloride followed by flocculation, sedimentation and filtration is an excellent alternative treatment to remove arsenic from drinking water. This paper presents results of a pilot-scale study conducted with groundwater from a well in Torreon, Coahuila, Mexico. The concentration of arsenic in water was 67 µg/ L. At doses of 8.5 mg/L of iron (coagulant) and 0.2 mg/L of an anionic polymer it was possible to obtain an arsenic removal efficiency of 93% and 98% of added iron. The concentration of dissolved solids and pH value of treated water compared to raw water did not change significantly. The sludge generated in the process may be thickened and disposed of in a landfill as it is not a hazardous waste. The cost of treatment per cubic meter was 0.0942 USD, this price includes the cost of reagents and energy.

Key Words: arsenic removal, coagulation, treatment cost

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ANÁLISIS DE LO INDICADOR DIARRREA EM LA EVALUACIÓN DE LA RELACIÓN ENTRE RESIDUOS SÓLIDOS Y SALUD

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Valdir Schalch²

*EVALUATION OF THE DIARRHEA INDICATOR IN THE ASSESSMENT
OF THE RELATION BETWEEN SOLID WASTE AND HEALTH*

Abstract

Diarrhea morbidity has been the most used health indicator in the assessment of the impact of sanitation improvement on health. There are few studies that have used this indicator for the assessment of the relation between solid waste disposal and human health. In the present work, diarrhea is used as a health indicator in a study developed to evaluate the health risk of people who live near a municipal solid waste landfill, located in the city of São Paulo, SP, Brazil. This epidemiological study used a transversal design. The study population was 972 children, from 1 to 5 years of age, living next to the landfill. The studied area was divided into 500-meter bands, starting from the landfill limit to define the exposure conditions. The health indicator used was diarrhea prevalence. A logistical regression model was used to study the factors related to diarrhea occurrence. In the study area, the data related to the following aspects were achieved: social and economical conditions of the family, house conditions and waste water system, water supply, domestic solid waste, urban drainage, biological and mechanical vectors, family and children health conditions and neighboring residential conditions. The results led to the conclusion that the diarrhea morbidity indicator was not specific to the assessment of the researched associations.

Key Words: Diarrhea Diseases, Environmental Exposure, Epidemiology, Landfill, Solid Waste.

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POTENCIAL DE OTIMIZAÇÃO DA PRODUÇÃO DE BIOGÁS GERADO POR UMA DIGESTÃO ANAERÓBIA EM ETES

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OPTIMIZATION POTENTIAL OF BIOGAS PRODUCTION IN
ANAEROBIC DIGESTERS ON MUNICIPAL WASTEWATER
TREATMENT PLANTS

Abstract

The biogas produced during the anaerobic digestion of wastewater sludge is often burned in order to reduce the greenhouse gas emissions. Very little of this biogas is used as an energy source in Brazil. In the present paper the volumes and characteristics of biogas produced at different anaerobic digesters in pilot and real scale in Brazil and Germany were determined, in order to evaluate the possibility of improvement of the anaerobic digester efficiency and study the availability of this biogas as alternative fuel. The biogas productions at the pilot plant experiments rendered 248 and 319 L biogas/kg dried solids (anaerobic digester sludge from bio filter and activated sludge processes). The biogas productions for real scale Wastewater Treatment plants (WWT) rendered 114, 480 and 310 L biogas/kg dried solids for three different activated sludge WWT plants, respectively in Brazil, Germany and Germany. The CH₄ and CO₂ concentrations of the biogas were between 65 – 70% and 30 – 35%. H₂S concentrations in the biogas were lower than 200 ppm for the real scale German WWT plants, between 600 and 800 for the pilot plants (Brazil) and higher than 1000 ppm for the real scale WWT plants in Brazil. The use of biogas as vehicle fuel can be economically feasible when compared to the fuel price.

KeyWords: Biogas, Anaerobic Digestion, Bio fuel

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EFEITOS DA ASSOCIAÇÃO DE ALGUNS SUBSTRATOS ALTERNATIVOS NO CONTEUDO DE NPK APÓS A COMPOSTAGEM E VERMICOMPOSTAGEM

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ASSOCIATION EFFECTS OF SOME ALTERNATIVE SUBSTRATES
ON THE NPK AFTER COMPOSTING AND VERMICOMPOSTING
PROCESSES

Abstract

Composting and vermicomposting processes were evaluated by studying the effects due to the association of some alternative substrates, at different portions (20, 40, 60, 80 and 100%) to the organic fraction of urban solid residues, which is known as "seedling". The results obtained through the experiments allow to conclude that several factors interfere on the quality of the generated product. In the composting process such factors are related to the substrate, the humidity control, the temperature, and on the way that the cells are revolved along the experiment. Of the analyzed substrate, the bovine manure (E) and pruning/weeding residue (R) they are preferential for the vermicompostagem process, for they associate characteristics as microflora, macroflora, size of particles and capacity of retention of water. In a general way, any substrate can be employees in the composting process and of vermicomposting. However, it is necessary to observe certain characteristic of those residues to presuppose the concentration of the elements NPK. The low concentration of the nutrients of the final product is related to the origin material. The composting processes and of vermicomposting they are technical that make available the nutrients, not having, therefore, won substantial in content of those nutritious ones that qualifies the composition generated as an effective substitute of fertilizing rights.

Key Words: composting, organics substrates, vermicomposting.

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ESTIMACIÓN DE LAS EMISIONES DE GEI ASOCIADAS AL CICLO DE VIDA DE LA GENERACIÓN TERMOELÉCTRICA DEL SISTEMA INTERCONECTADO CENTRAL

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*ESTIMATION OF GHG EMISSIONS ASSOCIATED WITH LIFE CYCLE
THERMOELECTRIC CENTRAL INTERCONNECTED SYSTEM*

Abstract

The increase in CO₂ emissions has become a topic of relevance because they generate negative consequences on the environment, being one of these global warming. This work considered the Chilean Central power grid (SIC) as study system, whose power generation is mainly based on hydro and thermal power. The methodology has been divided in two stages: the first is an analysis of the power generation life cycle, in order to identify, quantify and characterize its potential environmental impacts. In the second stage a projection of emissions has been developed through the implementation of present and future scenarios. We have found that plants present in the SIC emitted more than 18 million tonnes of CO₂ equivalent in the year 2008. In terms of projections for the years 2020 and 2025 it is expected that GHG emissions will increase due to an increased generation based on thermal processes, mainly coal, reaching values of 29 and 33 million tonnes of CO₂ for the respective years. Improving system efficiency contributes towards minimizing the GHG emissions from electricity generation systems, as the power generation process is the largest contributor of CO₂ emissions in the cycle thermoelectric life. It is therefore important to improve current power generation technologies, as this will directly reduce GHG emissions and fuel consumption, but also indirectly the latter has a high incidence in reducing emissions from other stages of life cycle such as extraction, refining and shipping.

Key Words: Central Interconnected System, GHG, life cycle analysis, power generation.

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