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شبكة المعلومات الجامعية

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التوثيق الإلكتروني والميكروفيلم

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بالرسالة صفحات لم ترد بالأصل

CAIRO UNIVERSITY
FACULTY OF ENGINEERING

MICROCONTROLLER-BASED CONTROL SYSTEM OF BIOLOGICAL WASTEWATER TREATMENT

THESIS

SUBMITTED FOR THE DEGREE OF
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BY

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ABSTRACT

Organic pollution disposal problems in wastewater treatment plants (wwtps) are solved by means of continuous activated sludge processing, in which sludge recycling and forced aeration secure a high efficiency treatment.

Treatment of municipal or industrial waste is an energy intensive process. The activated sludge aeration process is the biggest consumer of electricity. Optimum control of the process requires an accurate and reliable dissolved oxygen (DO) measurement on a continuous basis.

In the activated sludge, microorganisms (MO) are mixed thoroughly with the organic matter so that they can grow and stabilize the organic matter. As the microorganisms grow and are mixed by the agitation of the air, the individual organisms clump together (flocculate) to form an active mass of microbial floc called activated sludge. The mixed liquor flows from the aeration basin to a secondary clarifier where the activated sludge is settled. A portion of the settled sludge is returned to the aeration basin to maintain the proper food-to-MO ratio to permit rapid breakdown of the organic matter, some of it is wasted from the aeration basin or from the returned sludge line

to the sludge-handling systems for treatment and disposal. Air is introduced into the aeration basin either by diffusers or by mechanical mixers.

Several continuous processing schemes exist, ranging from aeration only to aeration-plus-sludge return to aeration plus sludge return with sludge wastage.

There are interesting coupling between water quality and dissolved oxygen (DO) concentration variation, therefore, dissolved oxygen concentration has long been recognized as a natural variable to be controlled in wastewater treatment.

The DO probe signal can be modeled by a first-order dynamic system and the change of the real DO concentration during (20-30 sec.) will change along a linear slope.

For a DO control system, the control action of the controller will be responsible for adjusting the delivery and distribution of air through manipulation of blower. In this work phase-angle control is used to control blower output.

This thesis deals with strategies and techniques can be used in implementing a microcontroller-based aeration basin

dissolved oxygen control system in two aspects.

First, simulation of dissolved oxygen (DO) process on an analog computer and considering the unit-step response of a DO dynamics for several values of proportional-integral (PI) parameters with a 8031 microcontroller. The stability of this response will be discussed with jury-criteria and root-locus method.

Second, for the sake of energy-saving an adjustable speed drive is proposed for a digital phase-angle blower control with a 8031 microcontroller.

The relation between the firing angle and the air flow rate of blower is deduced under phase-angle program via a 8031 microcontroller.

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