



Industrial Wastewater

Treatment

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NG Wun Jern

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## PREFACE

Students and engineers new to industrial wastewater treatment have often posed questions regarding the subject which may be answered from experience gained during multiple field trips. Organizing such site visits can however, be a difficult task because of time-management issues as well as the difficulties in gaining access to the various factories. This book was written to address some of these questions and to substitute a few of the site visits. It is a discussion of the material that goes into industrial wastewater treatment plants, the reasons for their selection and, where appropriate, how things may go wrong. Many photographs have been included so that the reader can get a better feel of the subject matter discussed.

Typically, students and engineers who wish to pursue a career in wastewater engineering begin from the study of domestic sewage and the design of sewage treatment plants. Their studies would then most likely extend to municipal sewage, which is a combination of domestic, commercial, raw and pretreated industrial wastewaters. Following which, some of these students may be briefly introduced to industrial wastewater treatment but their exposure to the subject would unlikely be of the same level as that of domestic sewage. Indeed, much of the expertise in the subject is gained through work experience. Many engineers, at least early in their careers, attempt to use the sewage treatment plant template or a modification of it for an industrial wastewater treatment plant.

How different is industrial wastewater treatment from sewage treatment? Is there a need to highlight the differences? Would these differences be large enough to result in differences in conceptualization, design and operation of industrial wastewater treatment plants? What are the potential pitfalls engineers should be aware of? There are obviously lessons to be learnt in sewage treatment which are relevant to industrial wastewater treatment. There is then the issue regarding the amount that can be transferred and the considerations that need to be taken into account to ensure an appropriate design is generated and the plant successfully managed.

Industrial wastewaters can be very different from sewage in terms of their discharge patterns and compositions. Notwithstanding this, many industrial wastewater treatment plants, for example and like sewage treatment plants, use biological processes as key unit processes in the treatment train. Given the variations in wastewater characteristics, ensuring these biological processes and upstream/downstream unit processes are appropriately designed presents a great challenge. The problems intensify when information on the wastewaters and their treatment is lacking. Textbooks frequently emphasize on the theories and equations used in designing unit processes. However, industrial wastewaters are so varied that it is difficult for the aspiring engineer to imagine why a certain process is selected over another, or why a particular variant is even selected at all. Additionally, there is a scarcity of books on “Asian” wastewaters and treatment facilities, which seems to be incongruous to the growing demand for Asia-focused books because of Asia’s rapid economic development.

This book is intended to introduce the practice of industrial wastewater treatment to senior undergraduate and postgraduate environmental engineering students. Practitioners of the field may also find it useful as a quick overview of the subject. The book focuses on systems that incorporate a biological treatment process within the treatment train, with the material of the book largely drawn from the author’s practice and research experiences. It does not delve into the details of theory or the “mathematics” of design, but instead discusses the issues concerning industrial wastewater treatment in an accessible manner. Some prior knowledge of the theory behind the unit processes discussed and the manner in which they are supposed to work is assumed. A description of a typical sewage treatment plant is provided to afford readers a point of familiarity and basis for comparison so that the differences can be more apparent. The book approaches the development of suitable treatment strategies by first identifying and addressing important wastewater characteristics. In the latter part of the book, a number of specific wastewaters are identified to serve as case studies so that individual treatment strategies and plant concepts can be move clearly illustrated.

Ng Wun Jern  
April 2005

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*Discussion on the biological processes used for secondary treatment of industrial wastewaters to remove organics and nutrients (where necessary). Aside from discussion on aerobic processes such as the conventional activated sludge and the cyclic SBR, space is also devoted to anaerobic processes used as the first stage of a biological treatment train to reduce organic strength prior to aerobic treatment. The difficulties faced by biological processes in industrial wastewater treatment are highlighted.*

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*The preliminary and secondary treatment stages generate sludges. These may be organic, inorganic, or a combination of the two. This chapter discusses sludge management approaches commonly adopted at IWTPs.*

*Chapters 4, 5 and 6 draw on experiences with actual wastewaters to illustrate points made in the discussions. These three chapters and Chapters 7–10 are provided with numerous photographs of plants, equipment, and site conditions so that the reader can develop a “feel” for the issues inherent in industrial wastewater treatment.*

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*total oxygen demand may be reduced. Failing this the strong nitrification may require alkalinity supplementation with attendant implications in terms of treatment chemicals and construction materials needed.*

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*The palm oil mill wastewater example provides a framework for discussion on the use of anaerobic processes to treat wastewaters and not as is usually encountered in STPs to treat sludges.*

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