CHAPTER I
INTRODUCTION

Water is one of the most important resources for process industry and water is used in many processes from various branches of industry. Wastewater is generated by processes and their utility systems. For example in the petroleum refinery, wastewater is generated when water is contacted with process materials in desalting, stream stripping and many washing operations. If we change the process or design the new water network to reduce their inherent demand for water, it will minimize amount of fresh water used in process and reduce wastewater discharged to environment.

The possibilities for reducing fresh water and wastewater by water network optimization are (Wang and Smith *et al.*, 1995)

1. *Water reuse.* Wastewater can be re-used directly in other operations providing the level of previous contamination does not interfere with the process by wastewater being blended with wastewater from other operation and/or fresh water. This is often referred to as the water reuse network (WRN).
2. *Regeneration re-used.* Wastewater can be regenerated by partial treatment to remove the contaminants and then re-used in other operation or blending with wastewater from other operation before re-used it.
3. *Regeneration recycling.* Wastewater is regenerated to remove contaminants and the treated water is recycled back to the process.

Water regeneration re-used and water regeneration recycling are referred to as the water treatment network (WTN).

Advantages of the redistributed system result from the fact that the cost of treatment is proportional to wastewater flow rate. Thus, a centralized WTN has to be expensive in most cases since a total wastewater stream flows through all treatment units. In a distributed wastewater treatment process, streams are either treated separately or only partially mixed, which reduces the effluent flow rate to be processed. A proper design of the treatment system should segregate the streams for treatment

and only combine them if it is appropriate. Minimization of wastewater flow rate through treatment processes is thus the main objective.

Previously, the water after regeneration is not supposed to use in the processes again in order to prevent accumulation of harmful substances with very low concentration in the processes.

Further reduction on both freshwater intake and wastewater discharge can be reached by additional application of water network synthesis with wastewater regeneration processes.

This work will develop methods to target and design water network for minimizing fresh water and wastewater in case of multi-contaminants system on water treatment network (WTN) by the mathematical programming. The models contain a large number of non-liner, non-convex terms, causing a global optimum cumbersome.