CHAPTER I

INTRODUCTION

In the purification of waters, the removal of suspended solids by filtration is an essential process. Rapid sand filters have been commonly used for over 60 years as an acceptable means for the removal of suspended impurities from raw and coagulated water. The development and improvement of filtration has proceeded slowly, by trial and error innovations, without basic knowledge of the mechanism of filtration by a porous sand bed. Attempts to analyse rationally a filter behavior, have been started since 1935, and a number of investigations have shown that the filtration process through graded media is a depth and time phenomenon. The investigations have also shown that the bulk of the particulate matter is removed in the upper layers of the filter with a consequent inefficient use of the total depth of bed because the lower layers of coarser sand is functioned only as a base for the fine sand.

In Thailand, water supply system was first established in Bangkok in 1914 and three years later in Thonburi. All rapid sand filtration plants are designed to operate at a filtration rate of about 2 gpm. per sq.ft. ($5\ m^3/m^2\text{-hr}$). Water problems increase from year to year

especially for the past decade, the population in Bangkok have been growing at an average annual rate of 5.7 percent. In 1966, as a result of the deficiency in water supply, the Thai Government appointed a committee to study the problems. The committee selected a consultant company and outlined the scope of work for the Master Plan to present estimation of population and water consumption in Bangkok Metropolitan Area up to the design year 2000, and to recommend water supply treatment plant and distribution facilities necessary to satisfy the expected water requirements. The Master Plan was completed in February 1970. It suggested that the new filter units will have media of sand and anthracite coal and will be backwashed by a combination of air and water. The filter loading rate will be 5 gpm. per sq ft. (12.5 m^3/m^2-hr) which is 2.5 times the rate used at the existing Sam Sen and Thonburi Plants.

To meet the rapid increase in demand for water in metropolitan area , The Master Plan recommended the construction of a new central filtration plant at Bangkhaen. However, it is realized that the work of such scopes will require several years of planning, design, financing and construction. This situation prompts the necessity of increasing the capacity of the existing facilities to cope with the demand in this interim period.

The stated problems inspired the writer of this thesis to investigate the concept of high rate filtration for improving performance with existing treatment units in the shortest possible time and at a minimum of cost.

Purpose of the Research

The purpose of the studies is to investigate the physical feasibility of direct filtration in removing turbidity by using a mixed media filter with alum. In direct filtration, the raw water after rapid mixing with alum, is applied directly to a filter without prior clarification by sedimentation, so the filter itself function as a flocculation reactor and a floc storage at the same time. The multi-media filter bed is constructed with upper layers of coarse particles of low density, and lower layers of finer particles of higher density. The media are graded hydraulically during backwash with the coarser, less dense media being transported to the top of each layer; the more uniform the particle size distribution is in each layer, the lesser will be the fine to coarse gradation in each layer.

Scope of Investigation

Synthetic raw water at different turbidites were used as influent directly applied to filter immediatly after rapid mixing. The rates of filtration were varied from 4, 6, 8, and 10 gpm per sq ft.(10, 15, 20 and 25m/m-hr)

The raw water from Sam Sen Canal was also investigated at different filtration rate. The turbidity of the water at various depths were measured periodically and recorded at the same time with manometer heads at the same depths. The observation of each run was terminated when either the headloss reached 7 ft. (210 cm) or the filtrate turbidity exceeded 0 .5 JTU (Jackson Turbidity Units). The turbidity of effluent, the lengths of filter run, and the headloss patterns were observed.