

CHAPTER I

INTRODUCTION



Since the past ten years, the number of vehicles has doubled itself within the Bangkok metropolitan area. As shown in Table 1, the total number of vehicles, as of 1976, amounted to 394,708. About 57 per cent out of these, or 223,439 vehicles, were the mixture of private cars, public cars, taxis and sam-lors. Most of these vehicles had to use the car-wash service from gasoline service stations and, as a result, these service stations were major water consumers to serve these vehicles washing. Undeniably, this heavy consumption of water would cause a lot of troubles to both the service stations themselves and the public as described below.

1. The service stations exploiting public water supply have paid and would continue to pay large sum of money for their business. It is also probable that water rates will be increased in near future especially in case of major consumers. This would force them to raise their car-wash service charges too high to attract enough customers to maintain their business. As far as the public is concerned, direct pumping of water from the pipeline by most service stations has deprived residents in their neighbourhood of chance to enjoy the public water facility.

2. The service stations exploiting ground water supply for their business have had to spend considerable sums of money on drilling deep wells which gave small yields and low-quality water. Moreover, some of these wells lasted shortly and additional wells had to be constructed again and again.

It is also interesting to note that underground water source has been widely exploited in Bangkok area to extent that not less than 1,000,000 m³ of water are drawn each day. This figure exceeds natural yield of the wells so much that its effect is realized by drastic drop of water level in many artesian wells. It has been found that the water level in these wells has

Table I - Statistics of Registered Vehicles in Bangkok
and Thonburi of the Fiscal years 1967 and 1976

No.	Type of Vehicles	1967	1976	Remark
*1.	Private car, not more than 7 persons carrying capacity Tax exemption	67,227 7,825	140,975 16,285	
*2	Private car, more than 7 persons carrying capacity (mini bus) Tax exemption	4,454 2,993	36,996 7,709	
*3	Taxi	8,998	13,634	
*4	Public samlor	6,855	6,589	
*5	Publiccars not more than 7 persons carrying capacity	-	993	
*6	Public cars more than 7 person capacity	-	258	
7	Diplomatic cars	632	681	
8	Inter chāngewage vehicle	-	619	
9	Private truck Tax exemption	24,689 7,033	41,855 14,511	
10	Public truck	2,235	5,108	

Table I. (Continued)

No.	Type of Vehicles	1967	1976	Remark
II	Tow truck	307	552	
	Tax exemption	68	41	
I2	Bus	2,796	5,142	
I3	Motorcycle	44,892	79,528	
	Tax exemption	2,408	14,667	
I4	Tractor	4,837	5,945	
	Tax exemption	-	1,523	
I5	Special permit (red plate)	-	412	
I6	Special hire	121	217	
I7	Roller (tax exemption)	175	231	
I8	Trailer	378	237	
I9	Side car	16	-	
	Total	188,939	394,708	

Source : Car Registration Section, Registration Division, Police Department.

Note * = Vehicles which had to use the car-wash service from service stations.

dropped over 20 metres in 15 years. Since 1974, the water level has dropped continuously at a rate of 2-3 metres annually, and the tendency is that this rate might increase as time goes by (HUTANGKUL, 1976). As the result, the construction of wells is certainly cost more in future, and in some cases, trouble might occur where water level is so deep that exploitation of ground water is not feasible.

Besides, even if researches have not been attempted in order to obtain significant data to confirm earth settlement in Bangkok area, like experience in other countries as Italy, Japan and the United States suggested that the existing massive rate of underground water drawing can contribute to the earth settlement activity in Bangkok area (SETAMANIT, 1975) which is hazardous to all of the residents in the long run.

3. Great part of the water obtained by the service stations are used for car washing in their routine business. This used washwater, then, drained into public sewers. Massive discharge of washed water from the service stations is likely to impose problem on the capacity of municipal sewage treatment plants once they are available.

It is believed that in order to relieve the problems described before, reuse of reclaimed automobile washed water should be adopted so as to minimize water consumption of the service stations as well as the amount of wastewater to be discharged into public sewers. Besides, McGARRY, et al (1973) stated that it is now generally recognized that the relatively fixed natural water resources and current of waste treatment techniques are inadequate to meet the ever-increasing urban water needs due to rapidly growing population and expanding industry, thus, it will be desirable to introduce reclaimed water to be used for "low level" purpose such as recreational lake supply for swimming pleasure, boating, sport fishing;

garden watering and municipal street washing. For these reasons, reclamation of automobile washed water for reuse will become inevitable in future.

In this research, a reclamation method in which burnt rice husk is used as media for the sake of its abundance and the ease of preparation, has been attempted. The storage ability as well as filtering efficiency of burnt rice husk is found to be advantageous and it is also lasting in service and low in cost. This research is expected to establish the feasibility of reclamation method of automobile washed water which is simple in design and construction as well as easy and economical in operation and maintenance.

Purposes of Research

The purposes of the research are:

1. To determine the quality of water used by service stations in Bangkok metropolitan area in their car-wash business: both before and after using.
2. To determine washwater consumption for automobile of service stations in Bangkok.
3. To identify possible effective method of reclaiming automobile washed water for reuse in a simple and inexpensive way with a view to minimize cost of water consumption and to provide new source of water to substitute natural water resources which had become inadequate to meet the increasing urban water demands due to rapidly growing population and expanding industry. Simultaneously, it was aimed to relieve the overloading of existing municipal waste disposal facilities. The attempt was made in trying a filtration method which used burnt rice husk (BRH) as the filter media for the sake of its availability and low cost. Evaluation was then made on a laboratory scale to determine:

- i) the optimum range of filtration rates;
- ii) the design parameters of the filter, for example, design depth of the media and etc;
- iii) the duration of filter run, attainable without excessive loss of head, as a function of depth and filtration rate; and
- iv) the efficiency of the media to remove turbidity.

4. To study the economic feasibility of the reclamation practice in substituting the existing practice in which either public water supply or underground water was exploited for car-wash business. Comparison of cost and benefit was made for both practices.

Scope of the Research

The scope of the research is as follows:

1. Two samples of water, both before and after using, will be taken at a time from each of twenty selected service stations in Bangkok metropolitan area at an interval of 3 days for a period of 2 weeks. The turbidity of those samples will then be determined.

2. Five sets of meters, on loan from the Metropolitan Water Works Authority, will be installed at 4 service stations in Bangkok, during 8th. February to 9th. April 1975, in order to determine the automobile washwater consumption for their business. The procedure will be as below:

- i) At service station 1 (DAO RACHAWAT) : will use 1 meter and record at 3-hour intervals, for 59 days;
- ii) At service station 2 (P. SAPAN LUENG) : will use 2 meters and record at 6-hour intervals, for 60 days;
- iii) At service station 3 (RUAM ^{CHAROEN} BORIKARN) : will use 1 meter and record at 12-hour intervals, for 59 days; and

iv) At service station 4 (MAHACHAI SERVICE) : will use 1 meter and record at 24-hour intervals, for 60 days.

3. A laboratory scaled filter will be installed at a service station in Bangkok (P. SAPAN LUENG). A number of laboratory tests will then be conducted to determine the effect of filtration on head loss, turbidity and pH.

Firstly, the automobile washed water will be allowed to flow along a concrete trough, where some portion of solid will be deposited, then to a grease trap where some portion of residual solid will be deposited and the grease removed. The outgoing effluent will then flow through the filter.

There are two experimental run series. Run series I will be carried out at various filtration rates in order to determine optimum filtration rate for the media. Run series I will be tested on burnt rice husk 0.80 m in depth, at filtration rates of 0.25, 1.25 and $2.50 \text{ m}^3/\text{m}^2/\text{hr}$ respectively and the rates kept constant throughout each run. Turbidity and pH of both the influent and effluent, as well as head loss throughout the depth of the bed will be measured at different times through the filter run. Evaluation will be made on these filtration rates to decide the optimum one for the media, by taking into consideration: duration of run, amount of filtered water, and total turbidity removed.

Run series II will be carried out later on at the optimum filtration rate obtained from run series I, and at various depths of the media in order to determine the optimum design parameters for the media. Run series II on burnt rice husk will be performed by keeping the optimum filtration rate, decided in the previous run series, constant throughout the run whereas the bed-depth varied at 0.80, 0.60 and 0.40 m respectively. Measurement will be made in a manner similar to

run series I on turbidity and pH of both the influent, effluent and head loss throughout the bed-depth. Duration of run, amount of filtered water, and total turbidity removed that determined from each run will be compared in order to decide the optimum depth of the media. Thus, determination of design parameters for burnt rice husk as the filter media will possibly.

4. Design of washed water reclamation for reuse system will be made with the consideration regarding capital investment, operation and maintenance costs.

5. Estimates of capital investment, operation and maintenance costs for the existing practices that exploiting public water supply or ground water resource for automobile-wash business will also be prepared.

6. Economic evaluation against either practice will be made to decide the feasibility and advantages of the reclamation for reuse system, at various water consumption, taking into account the annual cost and unit production cost for each practice.