CHAPTER 2

CRITERIA OF POLLUTION

The pollutional features of textile dyeing wastewater have divided into three main categories:

2-1 Physical Properties

Temperature

Textile dyeing wastewater discharged at an elevated temperature has a deleterious effect on the stream or the sewer receiving them, so that the wastewater should not be discharged until they have been cool to a reasonable temperature. Sudden discharge of high temperature wastewater into a stream may result in a direct fish kill unless the fish have already left the area of the stream because of previous similar discharges or other pollution. Warm wastewater also have a decreased capacity for dissolving oxygen available to them. A rise in temperature of a stream is likely to lead to deterioration of stream quality and perhaps to nuisance conditions. Not only does the high temperature reduce the amount of dissolved oxygen for bacterial oxidation of organic matter but the warmth accelerates bacterial action, and the oxygen that is available in rapidly depleted. Reaeration also is retarded because of the lessened oxygen solubility.

Suspended soilds

Suspended matter exists in many sizes and degrees settleability, usually classified as coarse and floating solids, settleable solids, fine or collcidal solids and floating films. It is desirable to

distinguish between settleable and nonsettleable solids because the former are likely to form sludge banks in stream or to clog sewer, whereas the finer materials flow practically by sedimentation basins but nonsettleable solids require special treatment such as chemical coagulation. Settleable solids are present in all natural streams, but excessive concentration are undesirable because they render the water turbid and unattractive in appearance. In addition, since most suspended solids are settleable under quiesent conditions, they have a tendency to form sludge deposits. In severe cases these sludge banks may interfere with navigation. When the sludge is partly organic in nature, as it almost inevitably is, anaerobic conditions soon develop: further decomposition results in gas formation that causes odors. Fine or nonsettleable solids include contaminants that are not in solution but are so finely divided they will not settle in a reasonable length of time. Fine solids may be directly detrimental to fish life, especially when the water is also polluted by chemical substances. Healthy fish can move through muddy water with little mechanical injury to their gills, but when acids or other chemical wastes injure the gills or alter the flow of mucus to the gills, the combined action of these chemical agents and the suspended solids are severe.

The principal objection to suspended solids are unesthetic appearance in the stream. It is, however, no different from silt and other natural suspended matter, unless the color is unusual. Suspended solids reduce light penetration into the stream water, affecting oxygen reaeration by photosynthesis.

Turbidity

Turbidity is a measure of the effect on light, and hence on appearance of the stream, caused by suspended and colloidal matter in the water. It is obvious esthetic significance, both in the stream itself and in any municipal water supplies taken from the stream. It may render the waters unsuitable for municipal supplies or for certain industrial uses. The presence of turbidity in municipal water supplied required expensive and elaborate treatment for purification of the water. The nature of the specific substance causing turbidity may be importance of other reasons, as for its contribution to BOD load. (Gurnham, 1955) In this research used spectrophotometer as shown in Figure 2 for measuring turbidity by reading the percentage of transmittance, and reading the turbidity in unit JTU (Jackson turbidity units) from the standard turbidity curve as shown in Figure 1

Odor

Odor may be a characteristic of the raw waste, or it may develop in the waste or the receiving river by decomposition of other pollutants. Obviously, odors are esthetically offensive, even at an appreciable distance from their source. (Gurnham, 1955)

2-2 Chemical Properties

Color

As chemical properties, we shall consider color, which is frequently caused by specific chemical compounds, although color itself is a physical phenomenon. Color is undesirable in streams

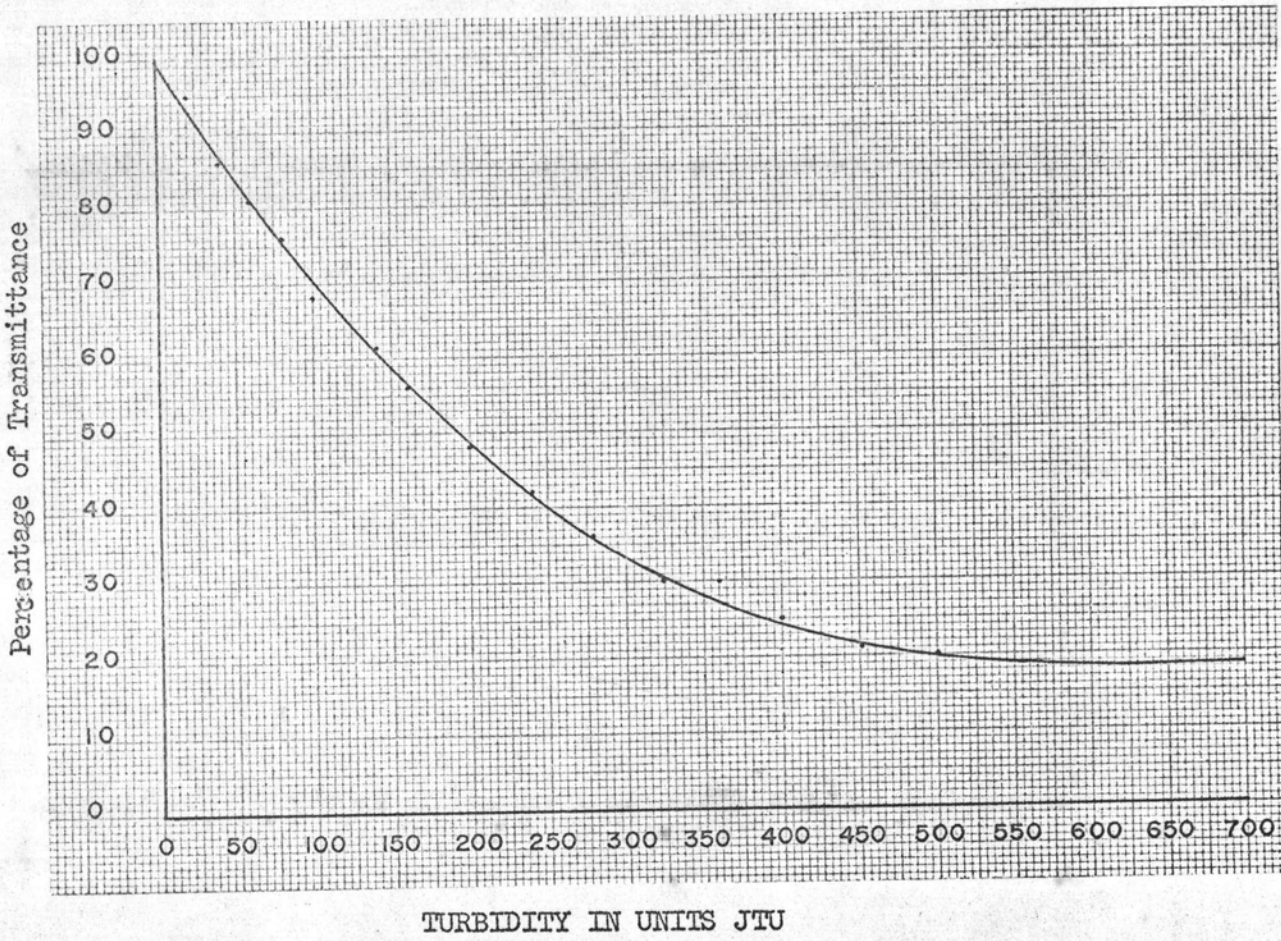

FIGURE 1 STANDARD TURBIDITY CURVE

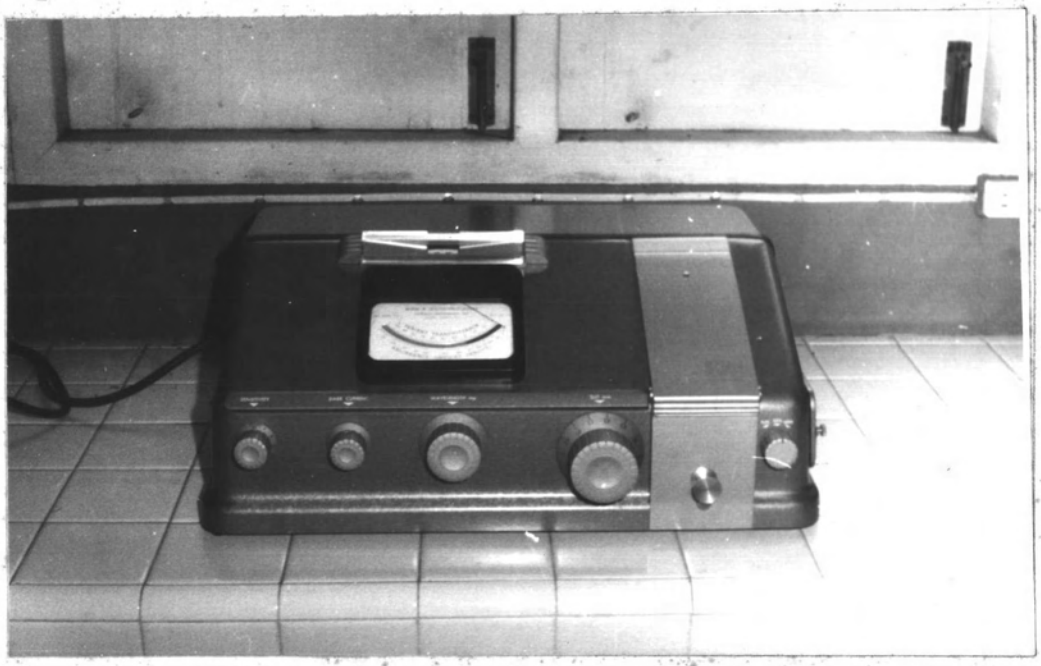

FIGURE 2 SPECTROPHOTOMETER FOR MEASURING COLOR AND TURBIDITY.

or rivers principally for esthetic reasons, or because it may be an indication of other, more serious, contamination. Textile dyeing wastewater with a high color content are obnoxious in many streams, particularly those used for recreation or as potable water sources. In these cases if the textile dyeing wastewater contain little else but color, it is usually sufficient to reduce the color by treatment to a point where dilution with the water of the stream or river will cause it to be unnoticeable. In certain cases, this may be accomplished by reducing the color in the plant to a definite degree and then piping some of the receiving river or stream water to a mixing chamber to combine with the wastewater effluent, so that the final mixture entering the river or stream has little or no visible color. In this research used spectrophotometers as shown in Figure 2 for measuring color by reading the percentage of transmittance, and reading the color in units from the standard color curve as shown in Figure 3.

TABLE 1 COLOR HUES FOR DOMINANT WAVELENGTH RANGES. (APHA, AWWA, 1970)

Wavelength Range (mμ)	Hue
400-465	Violet
465-482	Blue
482-497	Blue green
497-530	Green
530-575	Greenish yellow
575-580	Yellow
580-587	Yellowish orange
587-598	Orange
598-620	Orange red
620-700	Red
700-530 C	Blue purple
530 C-700	Red purple

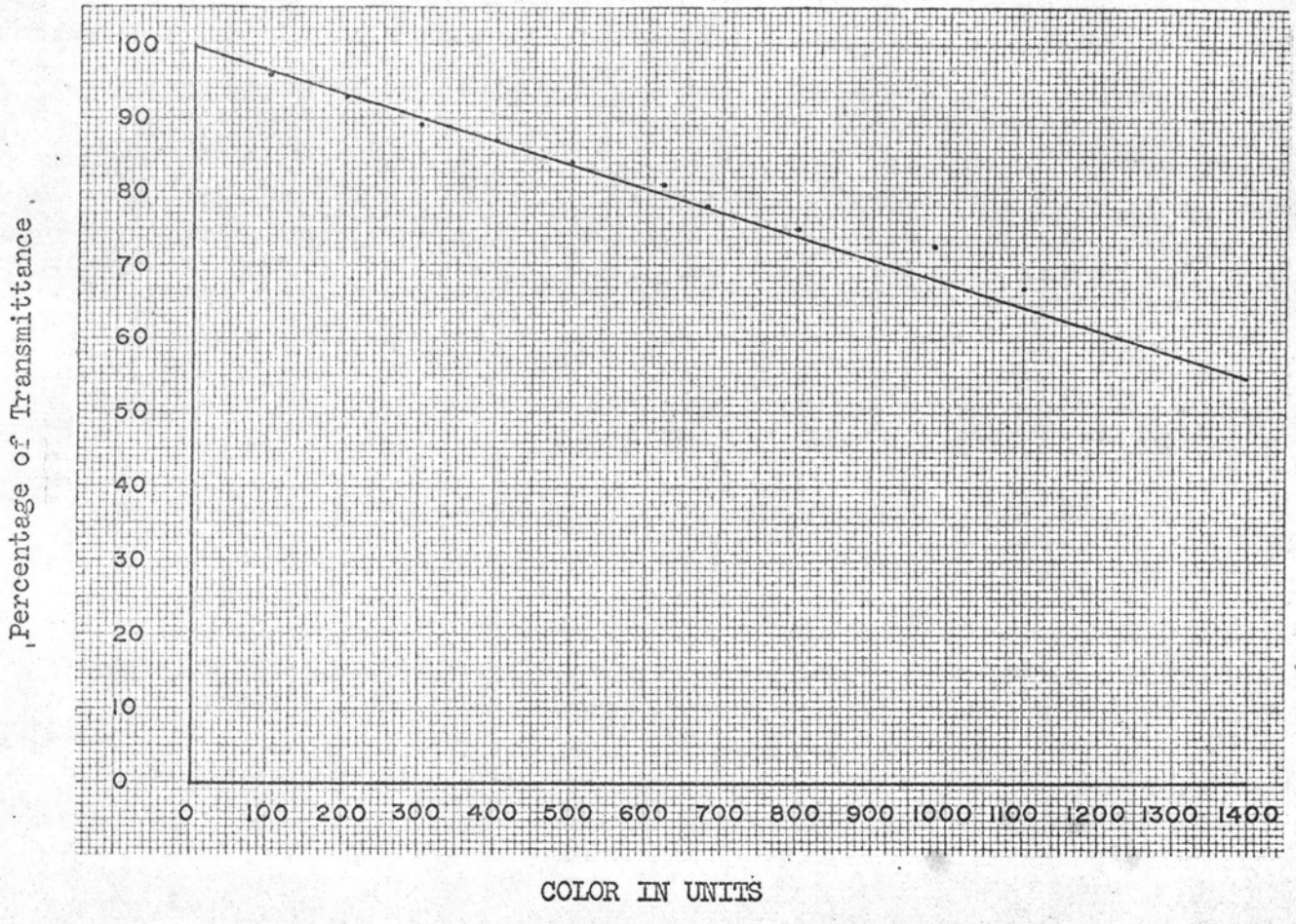

FIGURE 3 STANDARD COLOR CURVE

Acidity

Acidic wastewaters are harmful to natural streams and to sewerage systems in many ways, most obvious of which is their corrosive attack on metals, concrete and other materials of construction. In the sewerage systems this corrosion is destructive of concrete or irons pipes in the sewer and of equipment at the treatment plant, in streams corrosion affects boats, docks, navigational aids and many pumps or other equipment used to handle the water for industrial use. (Gurnham, 1955).

Alkalinity

Alkalinity wastewater are sometimes considered to be less objectionable than acid wastewaters in streams, because of the neutralizing effect of carbon dioxide adsorbed from the air, and because alkalines do not have the corresive action of acids. However, until this neutralization has taken place, which may be a lengthy process, alkaline wastewaters are as bad as acids in their effect on many organic materials, causing these to enter the water phase as solutions or colloids, which add color to the stream and increase to organic BOD load. (Gurnham, 1955).

pH

One of the most damaging characteristics of many industrial wastes, particularly from the inorganic industries, is their acid or alkali content. Either a high or a low pH may be damaging, causing fish kills and general sterility in natural streams, and inactivating the essential microorganism in sewage treatment processes.

Wastes of low p^H are corrosive to steel and concrete structures in waterways or sewerage systems. Fortunately, it is not difficult to eliminate extremes of p^H in wastewaters, by chemical neutralization. Adequate controls are available for this process, and the final effluent can be made suitable to either a stream or a sewer. (Gurnham, 1955).

2-3 Organic and Biological Properties

Biochemical oxygen demand (BOD)

The major pollution effect of organic wastes in a stream is their consumption of DO. under the influence of living microorganisms in the stream environment. The rate and extent of oxygen depletion is customarily evaluated by the biochemical oxygen demand, or BOD, test. This is not a direct measure of organic content, but is a measure of its most significant pollutional characteristic, the capacity to consume oxygen. The BOD of a waste indicates to a certain degree the type and extent of treatment which must be employed to reduce the oxygen absorbing power to a point where it will not reduce the oxygen content of the stream to a dangerous point. Some wastes have a low solids content but a very high oxygen demand, others have a high solids content and a relatively low oxygen demand. A different type of treatment and perhaps an entirely different process of treatment may be required to treat these two kinds of wastes. (Gurnham, 1955)

Chemical oxygen demand (COD)

The chemical oxygen demand test is widely used as a means of measuring the pollutional strength of domestic and industrial wastes. This test allows measurements of a waste in terms of the total quantity of oxygen required for oxidation to carbon dioxide and water. It is upon the fact that all organic compounds, with a few exceptions, can be oxidised by the action of strong oxidizing agents under acid conditions. The amino nitrogen will be converted to amonia nitrogen. However, organic nitrogen in higher oxidation states will be converted to nitrates. (Sawyer, 1967).

Chemical oxygen demand test is particularly useful in the analysis of industrial wastes containing toxic substances that inhibit biological growth and render the BOD test unreliable. (Gurnham, 1955).

The BOD:COD ratio of wastewater is indicative of the fraction of dichromate - oxidizable materials, which is amenable to biological degradation. A high ratio, for example, would indicates that many of the dissolved organic materials can be degraded biochemically, while a low value would indicate the presence of a significant fraction of bioresistant organic constituent. (JWPCF, August 1971)

Toxicity

Many industrial wastes are toxic in the concentration at discharge, or even after dilution in the receiving stream toxic contaminants in a water prevent testing for BOD, unless they can diluted to the extent of destroying toxicity without weakening the concentration too far to measure The COD test is used instead of BOD under these conditions. (Gurnham, 1955)