

# Changes in Quality of Brackish Water from Dawei River, Dawei District in Tanintharyi Region

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**Abstract:** In this research, brackish water samples in Dawei river of Talaingya village, Yephyu Township and Thinbawseik quarter, Dawei Township, Tanintharyi region were collected in September, 2017. Location of the brackish water samples Talaingya village, Yephyu Township and Thinbawseik quarter, Dawei Township, Tanintharyi region were 14°17'52.58"(N) 98°11'27.33" (E) and 14° 04' 18.99" (N) and 98° 11' 4.02"(E). Determination of water quality parameters; pH values by pH meter, dissolved oxygen by DO meter, temperature by temperature sensor built-in probe in DO meter, total dissolved solids by gravimetric method, total suspended solids by filtration method, chemical oxygen demand (COD), alkalinity, total hardness, salinity, chlorinity by titrations method were carried out. Mineral contents of brackish water sample were determined by atomic absorption spectrophotometric (AAS) method.

**Keywords:** Brackish water; alkalinity; total hardness; salinity and mineral contents.

## I. Introduction

### *River Water*

Rivers are part of the created canyons or gorges. Rivers have been used as a source of water, for obtaining food, for transport, as a defensive measure, as a source of hydropower to drive machinery, for bathing, and as a means of disposing of waste (Meybeck, 1993). Rivers have been used for navigation for thousands of years (Albrecht, 2003).

### *Geography of Dawei River Water*

The area around the Dawei River estuary has been inhabited for centuries by Mon, Kayin, and Thai mariners (Aye Thidar Kyaw, 2011). It has its source in the Tanintharyi Hills and flows from north to south, the northern branch of the Tanintharyi River running parallel to it. It ends in the Andaman Sea coast. In the last stretch of its course it forms a navigable estuary before it meets the sea. Off the shore there are a number of small islands on the western side of the estuarine area (Wikipedia, 1991).

### *Brackish Water*

Brackish water or briny water is water that has more salinity than fresh water, but not as much as seawater. It may result from mixing of seawater with fresh water, as in estuaries, or it may occur in brackish fossil aquifers. Technically, brackish water contains between 0.5 and 30 grams of salt per liter more often expressed as 0.5 to 30 parts per thousand (%), which is a specific gravity of between 1.005 and 1.010. It is characteristic of many brackish surface waters that their salinity can vary considerably over space or time (Moustakas and Karakassis, 2016).

### *Brackish Water Habitats*

Brackish water condition occurs when fresh water meets seawater. In fact, the most extensive brackish water habitats worldwide are estuaries, where a river meets the sea. A similar pattern of replacement can be observed with the aquatic plants and invertebrates living in the river (Wikipedia, 2003).

## II. Materials and Methods

### *Collection of Samples*

In this research, brackish water samples were collected from Talaingya and Thinbawseik of Dawei river at rainy season. The brackish water samples were taken from 5 feet depth from the surface level. The samples were collected in September, 2017. (Table.1 and Figure.1)

Table.1 Geolocation of the Sampling Sites of Study Area

Sr.No	Location	GPS position
1	Talaingya	14°17'52.58" N 98°11'27.33" E
2	Thinbawseik	14° 04' 18.99" N 98° 11' 4.02" E



Figure.1 Map of water samples collecting sites from Dawei river

### *Determination of pH*

The pH values of brackish water samples were detected by pH meter.

### *Determination of Temperature*

The temperature values of brackish water samples were detected by DO meter.

### *Determination of Dissolved Oxygen*

The dissolved oxygen values of brackish water samples were also detected by DO meter.

### *Determination of Total Dissolved Solids*

Total dissolved solid values of brackish water samples were detected by Gravimetric method.

### *Determination of Total Suspended Solids*

Total suspended solid values of brackish water samples were detected by Filtration method.

### *Determination of Chemical Oxygen Demands*

Chemical oxygen demands in brackish water samples were determined by using titrimetric Method.

### *Determination of Alkalinity*

Alkalinity values of brackish water samples were detected by titrimetric method.

### *Determination of Total Hardness*

The total hardness of brackish water samples were detected by complexometric method.

### *Determination of Chlorinity and Salinity*

Chlorinity of the brackish water samples were detected by Mohr's modified method and converted into salinity using Knudsen equation.

### *Determination of Mineral Contents*

Atomic absorption spectrophotometer (AAS) is particularly suitable for analysis of micro components or trace elements of brackish water samples.

## III. Results and Discussion

The brackish water samples were collected from two different locations of Dawei river on September, 2017. Sample collection and testing of water qualities were continuously made. Table (2) showed the pH, temperature and dissolved oxygen of brackish water samples from Dawei river. The pH values of brackish water samples in Dawei river of Talaingya village and Thinbawseik quarter are 7.9 and 7.8. According to the data, water samples of Talaingya village and Thinbawseik were indicated that they were greater than 7. So water samples of Talaingya village and Thinbawseik quarter were alkalinity. Water temperature is one of the most important physical characteristics of aquatic systems. As water temperature rises, the rate of photosynthesis increases, thereby providing adequate amounts of nutrients (FOEN, 2011). The temperature of brackish water samples in Dawei river of Talaingya village and Thinbawseik quarter are 28.9 °C and 27.0 °C. Dissolved oxygen is necessary to many forms of life including fish, invertebrates, bacteria and plants (EPA, 2014). Dissolved oxygen of brackish water samples in Dawei river of Talaingya village and Thinbawseik are 7.18 and 7.12 ppm. The dissolved oxygen concentrations of the brackish water samples were in agreement with the \*UNEP Standard (4 to 8 ppm).

Table 2. pH, Temperature and Dissolved Oxygen of Brackish Water Samples from Dawei river

Sample site	pH	Temperature (°C)	Dissolved oxygen(ppm)
Talaingya	7.9	28.9	7.18
Thinbawseik	7.8	27.0	7.12
<b>*UNEP Standard</b>	6.5 - 8.5	-	4 - 8

\*UNEP- United Nations Environmental Water Quality Standard for Aquatic Life Protection (\*UNEP, 2004)

### Total Dissolved Solids and Total Suspended Solids in Dawei River Water Samples

TDS comprises inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulfates) and small amounts of organic matter that are dissolved in water (WHO, 2003). In this study, TDS values of brackish water samples in Dawei river of Talaingya village and Thinbawseik quarter are 0.063 and 0.146 ppm respectively. Turbidity readings are somewhat dependent on particle size, shape, and color, this approach requires calculating a correlation equation for each location (Clescerl, *etal.*, 2001). TSS values of brackish water samples in Dawei river of Talaingya village and Thinbawseik quarter are 0.029 and 0.123 ppm. (Table.3 and Figure.2)

Table 3.Total Dissolved Solids and Total Suspended Solids in Brackish

Water Samples from Dawei river

Sample site	Total dissolved solids (ppm)	Total suspended solids (ppm)
Talaingya	0.063	0.029
Thinbawseik	0.146	0.123

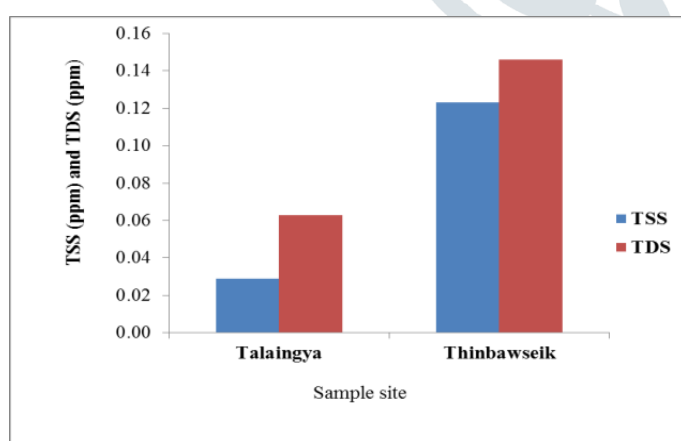


Figure.2 Total dissolved solid and total suspended solids in brackish water samples from Dawei river

### Chemical Oxygen Demand in Dawei River Water Samples

The amount of oxygen required to oxidize any organic matter in the water using harsh chemical conditions (Ganjar and Sarwoko, 2010). The chemical oxygen demand of brackish water samples in Dawei river of Talaingya village and Thinbawseik quarter are 0.4 and 3.1 ppm in rainy season. Values of brackish water samples in Dawei river of Talaingya village and Thinbawseik quarter were lower than \*UNEP standard. (Table.4)

Table 4. Chemical Oxygen Demand (COD) Contents of Brackish Water Sample from Dawei River

Sample site	Chemical oxygen demand (ppm)
Talaingya	0.4
Thinbawseik	3.1
*UNEP Standard	< 40

#### *Alkalinity and Total Hardness in Dawei River Water*

Measuring alkalinity is important in determining a stream's ability to neutralize acidic pollution from rainfall or wastewater. It is one of the best measures of the sensitivity of the stream to acid inputs (Kaushal, et al., 2013). In this study, the alkalinity values of brackish water samples in Dawei river of Talaingya village and Thinbawseik quarter are 40 ppm and 60 ppm respectively. Hardness caused by calcium is called calcium hardness, regardless of the salts associated with it. Likewise, hardness caused by magnesium is called magnesium hardness. Removing hardness from water is called softening and hardness is mainly caused by calcium and magnesium salts. In this study, the total hardness values of brackish water samples in Dawei river of Talaingya village and Thinbawseik quarter are 80 and 40 ppm. The results were shown in Tables 5.

Table 5. Alkalinity and Total Hardness of Brackish Water Samples from Dawei river

Sample site	Alkalinity (ppm)	Total hardness (ppm)
Talaingya	40	80
Thinbawseik	60	40

#### *Chlorinity and Salinity of the Brackish Water Samples*

Chlorinity is the total amount of dissolved salts in water; grams of salt per kilogram of water (g/kg) or as parts per thousand (ppt). Chlorinity is the total amount of dissolved salts in water; grams of salt per kilogram of water (g/kg) or as parts per thousand (ppt). The average salinity of the world's oceans is 35 ppt. Freshwater has a salinity of < 1 ppt. The brackish water has a salinity values between 1 - 25 ppt. Waters with salinity greater than 40 ppt are called hyper saline (Anderson, et al., 2003). In this study, chlorinity contents of the brackish water samples in Dawei river of Talaingya village and Thinbawseik quarter are 0.0115 and 0.0142 ppt at rainy season. Salinity contents of the brackish water samples in Dawei river of Talaingya village and Thinbawseik quarter are 0.0508 and 0.0556 ppt respectively. (Table.6)

#### *Mineral Content of Brackish Water Samples from Dawei River*

Aquatic contamination by trace metals is potentially a significant environmental concern, given their ability for redistribution and chemical modification in the environment. The latter will be important if it affects the proportion of trace metal present as the free metal ion which is considered to be the major bioavailable form of many trace metals for uptake by aquatic organisms (Rainbow, 1997). In the present work, the mineral contents in Dawei river water samples were determined by atomic absorption spectrophotometer. The minerals found in Dawei river water samples are Cu, Cr, Fe, Mn, Pb, Cd and Ca. These data were shown in Table 7.

Table 6. Chlorinity and Salinity of Brackish Water Samples from Dawei River

Sample site	Chlorinity (ppt)	Salinity (ppt)
Talaingya	0.0115	0.0508
Thinbawseik	0.0142	0.0556

Table 7. Mineral Content in Brackish Water Samples from Dawei River by AAS Method

No	Element	Sample location sites		UNEP Standard (ppm)
		Talaingya (ppm)	Thinbawseik (ppm)	
1	Cu	0.0031	0.0045	0.008
2	Cr	0.0083	0.0019	0.05
3	Fe	0.0041	0.0128	1
4	Mn	0.0033	0.0019	-
5	Pb	0.0317	0.0664	0.05
6	Cd	0.0009	0.0023	0.01
7	Ca	0.0068	0.0079	-

#### IV. Conclusion

The aim of this research is to study the changes in quality of brackish water at Dawei River. Location of the brackish water samples from Talaingya village and Thinbawseik quarter at Dawei River were 14° 17' 52.58" (N) , 98° 11' 27.33" (E) and 14° 04' 18.99" (N) , 98° 11 ' 4.02" (E). The water samples were collected in September, 2017.

In this research, the pH values of brackish water samples in Dawei river of Talaingya village and Thinbawseik quarter were found to be 7.9 and 7.8. The pH values of the brackish water samples were agreement with the \*UNEP Standard (6.5 - 8.5). The temperature values of the brackish water samples were determined by temperature built-in probe in DO meter. Temperature of brackish water samples in Dawei river of Talaingya village and Thinbawseik quarter are 28.9 °C and 27.0 °C respectively. The DO values of the brackish water samples in Dawei river of Talaingya village and Thinbawseik quarter are 7.18 and 7.12 ppm respectively. These values were agreements with the \*UNEP Standard (4 - 8 ppm).

Total dissolved solids (TDS) of brackish water samples in Dawei river of Talaingya village and Thinbawseik quarter are 0.063 and 0.146 respectively. The total suspended solids values of the brackish water samples were determined by Filtration method. Total suspended solids (TSS) of brackish water samples in Dawei river of Talaingya village and Thinbawseik quarter are 0.029 and 0.123 ppm respectively. Chemical oxygen demand of brackish water samples in Dawei river of Talaingya village and Thinbawseik quarter are 0.4 and 3.1 ppm respectively. Alkalinity values of the brackish water samples were determined by titrimetric method (acid-base titration). Alkalinity of brackish water samples in Dawei river of Talaingya village and Thinbawseik quarter are 40 and 60 ppm respectively. Total hardness values of the brackish water samples were determined by Complexometric method. Total hardness of brackish water samples in Dawei river of Talaingya village and Thinbawseik quarter are 80 and 40 ppm respectively. Chlorinity values of the brackish water samples were determined by Mohr's titration method. Chlorinity contents of brackish water samples in Dawei river of Talaingya village and Thinbawseik quarter are 0.0115 and 0.0142 ppt



respectively. Salinity of brackish water sample in Dawei river of Talaingya village and Thinbawseik quarter are 0.0508 and 0.0556 ppt respectively. In this research, the parameters such as chemical oxygen demand (COD), alkalinity, total hardness, chlorinity and salinity of brackish water samples in Dawei river of Talaingya village was lower than Thinbawseik quarter. Water is commonly classified in terms of the degree of hardness as 0 – 75 ppm is soft, 75 - 150 ppm is moderately hard, 150 - 300 ppm is hard and 300 ppm and above is very hard. So the values of the brackish water samples in Dawei river of Talaingya village were moderately hard and Thinbawseik quarter was very hard. Mineral elements in the brackish water samples were determined by Atomic Absorption Spectrophotometric method. Ca, Mg, Cu, Pb, Cd, Mn and Cr were detected in all samples. Heavy metal pollution is a major problem for the Dawei river. In the present study, concentration of Pb content in Thinbawseik quarter water sample is higher than the safe values which indicated that the Thinbawseik quarter is polluted by studied heavy metals. It can be suggested that the water of the Dawei river in Thinbawseik quarter would not be suitable for irrigation and domestic purpose without treatment. According to my result, water quality varies from place to place, with seasons, with climate, and with the types of solids and rocks through which water moves. Talaingya village water sample is more suitable for irrigation and domestic than Thinbawseik quarter water sample.

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