

# Inventory of microalgae at Sepanjang Beach the coastal area of Gunung Kidul Jogjakarta

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**Abstract:** Research conducted in the coastal area along Sepanjang Beach Gunung Kidul Jogjakarta aims to find out what types of microalgae are present in the region. The area of Sepanjang Beach Gunung Kidul Jogjakarta is one of the most favourite beach visited by tourists both domestic and foreign. The research was conducted in March - October 2018. The sampling method used was Purposive Sampling where it was determined as many as 5 sampling points called the Station. Then at each station created 2 substations are made as replications. From the results of the study found as many as 12 species from 4 families namely Bacillariophyceae, Chlorophyceae, Euglenophyceae and Cyanophyceae. Of the four families produced 12 species including *Navicula sp.*, *Euglena viridis*, *Spirulina sp.* and *Oscillatoria sp.* It indicates that the environment is still good.

**Keywords :** Sepanjang Beach, Gunung Kidul Jogjakarta, microalgae, Protists, microorganism

## Introduction

Microalgae commonly known as phytoplankton (Abubakar, Mutie, & Kenya, 2011) is an organism is a food from higher organisms, namely aquatic herbivores like herbivorous fish and invertebrates. Microalgae habitat is both fresh and marine waters. Microalgae is a part of primary productivity in watering ecosystem (freshwater and also marine). Some microalgae divide into several groups according the habitat they're found, their terms such as biofilm, benthos, periphyton and epilithon (epilithic) (Al-Harbi, 2017). Plankton has long been known, around the 1920s. at that time it was believed that there were very small bacteria that were found in a food chain in the coastal region. In the 1970s only began to be investigated about the diversity and abundance of plankton in the territorial waters (Vaulot, Eikrem, Viprey, & Moreau, 2018).

Microalgae has chloroplasts, so that they can do photosynthetic mechanism. Microalgae also have sources of secondary metabolites called bioactive compounds such as polyphenol, vitamins, lipids (for biofuels) and proteins (Azaman, Nagao, Yusoff, Tan, & Yeap, 2017). Metabolic reactions from microalgae Bioreaction metabolism from microalgae is also able to form supplement food is nutrient for metabolic reaction for human. Lipids and fatty acid from microalgae is also used as a medicine for cardiovascular disease. It is also a food for herbivores in the sea but is also used as an additional food for humans (Mimouni, et al., 2015).

Besides, carotenoids from microalgae, are good for antioxidants, for example, *Dunaliella salina* is source of  $\beta$ -carotene and *Haematococcus pluvialis* is source of astaxanthin (Raposo, Morais, & Morais, 2015).

The distribution of microalgae are widely in equatorial. Tropical regions are the regions with the highest levels of diversity, especially microalgae. Gradient influenced the richness an abundance of microalgae (Kerswell, 2006).

## MATERIALS AND METHOD

We compile the species name of microalgae from the primary literature (paper and guides book marine and freshwater of microalgae (Bellinger & Sigeo, 2010). The location in Sepanjang Beach Gunung Kidul Jogjakarta in the maps (Fig 1). The distance between plots are 10- 20 m.

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The samples of microalgae are identify in laboratory for the next step. The ecological parameters identidy suc as temperature, humidity and acidity of water.



Figure 1. research area in Sepanjang Beach are divide into 5 spots (red dots). Insert : the condition of on site

## RESULT AND DISCUSSION

### *Microalgae Diversity*

Results of research on microalgae diversity at Sepanjang Gunung Kidul Beach Yogyakarta at station 1, station 2, station 3, station 4 and station 5 (Table.1).

Table 1. Results of identification of microalgae at the Pantai Panjang Gunung Kidul Yogyakarta

Divisi	Classis	Genus	Species	Plots				
				1	2	3	4	5
Thallophyta	Bacillariophyceae	Navicula	<i>Navicula</i> sp.	-	+	-	-	-
			<i>Navicula transitans</i>	-	-	+	-	-
			<i>Navicula tripunctata</i>	-	-	-	-	+
	Cymbellaceae	Cymbella	<i>Cymbella tumida</i>	-	-	-	-	+
	Gomphonemataceae	Gomphonema	<i>Gomphonema</i> sp.	-	-	-	+	-
	Achnanthaceae	Achnanthes	<i>Achnanthes</i> sp.	-	-	+	-	-
			<i>Achnanthes inflata</i>	-	-	+	-	-
	Chlorophyceae							

	Famili :	Ankistrodesmus	<i>Ankistrodesmus</i>	-	-	-	+	+
	Selenastraceae		<i>densus</i>					
	Euglenophyceae							
	Famili :	Euglena	<i>Euglena viridis</i>	-	-	-	-	+
	Euglenaceae							
Schizophyta	Cyanophyceae							
	Famili :	Spirulina	<i>Spirulina</i> sp.	-	+	-	-	-
	Oscilatoriaceae							
		Oscillatoria	<i>Oscillatoria</i> sp.	-	-	-	-	+
	Number of species found			-	2*	3	2*	5**
	Total number							12

Based on the results of the study found that the number of microalgae found most in the plot of 5 coastal areas of Sepanjang. Bacillariophyceae class dominates the research area (Table 1). The species found are *Navicula* sp. , *Cymbella tumida*, dan *Achnanthes* sp. Species *Navicula* sp dan *Achnanthes* sp. are bentic diatoms which has 1.25 and 1.08 g/L on dry weight. This microalgae is one of the antioxidant-producing compounds of its body solution (Lee, et al., 2008).

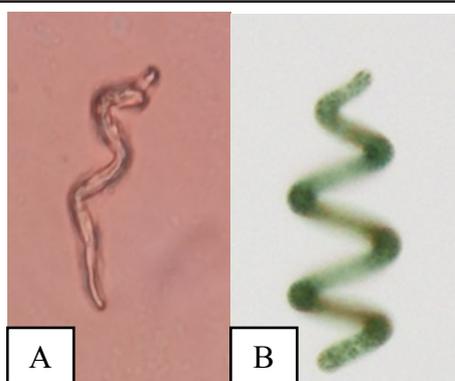
### Measurement results of Abiotic Parameters in Kemanten Offspring Sidowayah Village, Polanharjo District, Klaten Regency

The results of the measurement of environmental conditions of the Kemanten Bulbul waters in Sidowayah Village, Polanharjo District, Klaten Regency in 2018 (Table 3).

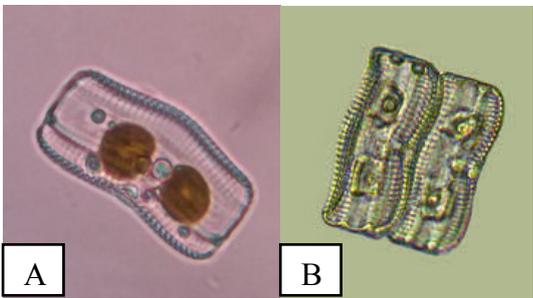
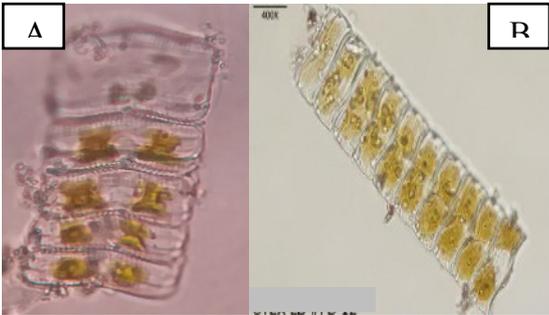
Table 3 Results of measurement of abiotic parameters in Umbul Kemanten

No	Abiotic parameters	Measurements result				
		Station 1	Station 2	Station 3	Station 4	Station 5
1	Water temperature (°C)	22°	24	25	23	24
2	Air temperature (°C)	26,9	25,5	26,3	25,6°	25,7
3	Humidity (%)	73	86	84	88,5	84,5
4	pH	5	5	4,5	4,25	4,75

### Microalgae Taxonomy Level

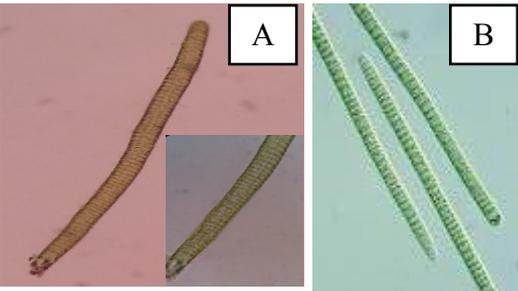
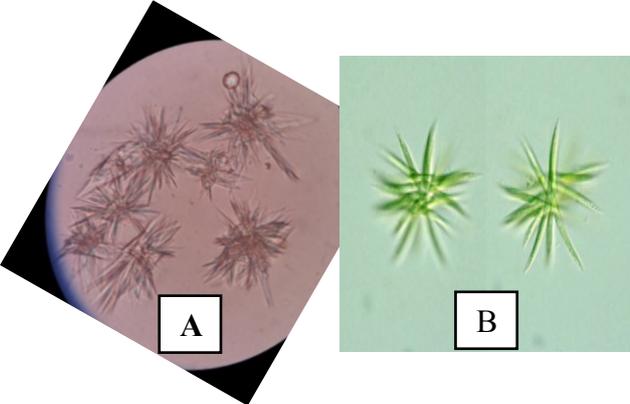
No	Species	Taxonomy	Figure
1	<i>Spirulina</i> sp.	Divisi : Thallophyta Classis : Cyanophyceae Ordo : Nostocales Famili : Oscillatoriaceae Genus : <i>Spirulina</i> Spesies : <i>Spirulina</i> sp.	

	Determination keys : 1b, 3a, 4b, 43a, 44b, 46b, 53a ..... Genus : Rhizosolenia.	a. Personal documentation b. Source : <a href="http://www.algaebase.org">www.algaebase.org</a>
	<p>Description :</p> <p>Spirulina is a bluish-green microalgae whose life is spread in all ecosystems both land ecosystems and aquatic ecosystems such as fresh water, sea water, and brackish water. Including autotrophic microorganisms with colonized cells form helix (spiral) twisted filaments, so-called filamentous microalgae. Spirulina body shape that resembles a thread is a series of cylindrical cells with a thin cell wall, a diameter of 1-12 micrometers. The benefits of spirulina, among others, can be consumed as food, a source of protein and contain vitamins. Spirulina contains blue pigment, phycocyanin, which can boost immunity and produce anti-cancer. Spirulina spp are functioned in agriculture, food industry, pharmaceuticals, perfumery and medicine (Hoseini, Khosravi-Darani, &amp; Mozafari, 2013).</p>	
2	<p><i>Navicula</i> sp.</p> <p>Divisi : Thallophyta Classis : Diatomeae Ordo : Naviculales Famili : Naviculaceae Genus : Navicula Spesies: <i>Navicula</i> sp.</p>	 <p>A B</p>
		a. Personal documentation b. Source : <a href="http://www.algaebase.org">www.algaebase.org</a>
3	<p><i>Navicula transitans</i></p> <p>Divisi : Thallophyta Classis : Diatomeae Ordo : Naviculales Famili : Naviculaceae Genus : Navicula Spesies: <i>Navicula transitans</i></p> <p>Sumber : <a href="http://www.algaebase.org">www.algaebase.org</a></p>	 <p>A B</p> <p>(A) dokumentasi pribadi (B) <a href="http://planktonnet.awi.de">http://planktonnet.awi.de</a></p>
4	<p><i>Navicula tripunctata</i></p> <p>Divisi : Thallophyta Classis : Diatomeae Ordo : Naviculales Famili : Naviculaceae Genus : Navicula Spesies: <i>Navicula tripunctata</i></p> <p>Sumber : <a href="http://www.algaebase.org">www.algaebase.org</a></p>	 <p>A B</p> <p>(A) dokumentasi pribadi (B) <a href="https://naturalhistory.museumwales.ac.uk">https://naturalhistory.museumwales.ac.uk</a></p>

	<p>Key Determination : 126a, 127 b, 139b, 144b, 145b, 147b, 148b, 151b, 152b, 153b, 154b, 155b, 157b, 165b, 166b, 167b, 170b, 176b, 191b, 192b, 193b, 195b, 196b, 198b, 199b, 200b, 201b ..... Genus : Navicula</p> <p>Description : Navicula is a genus whose cells have a lanceolate valve with a narrow axial area flanked by fine striae. Cells can be motile or do naviculoid movements. Each cell has one or more chloroplasts. Round or sub capitate cell ends with two chloroplasts such as plates on both sides of the apical axis. Navicula can be found in various benthic waters in rivers and lakes. The form of a cell like a ship, Navicula belongs to a group of aquatic creatures, eukaryotic, can photosynthesize and measure from a single cell. An important role in global ecology that produces about a quarter of all oxygen in the Earth's biosphere and acts as a key species in the food chain in the aquatic environment. Navicula diatom has potential od tropical marine for biodiesel (Nurachman, Brataningtyas, Hartati, &amp; Panggabean, 2012).</p>		
5	<p><i>Achnanthes</i> sp.</p>	<p>Divisi : Thallophyta Classis : Diatomeae Ordo : Mastogloiales Famili : Achnanthaceae Genus : Achnanthes Spesies: <i>Achnanthes</i> sp.</p> <p>Sumber : <a href="http://www.algaebase.org">www.algaebase.org</a></p>	
5	<p><i>Achnanthes inflata</i></p>	<p>Divisi : Thallophyta Classis : Diatomeae Ordo : Mastogloiales Famili : Achnanthaceae Genus : Achnanthes Spesies: <i>Achnanthes inflata</i></p> <p>Sumber : <a href="http://www.algaebase.org">www.algaebase.org</a></p>	 <p>(A) dokumentasi pribadi (B) <a href="https://utex.org">https://utex.org</a></p>
	<p>Key determination : 126a, 127b, 139b, 144b, 145b, 147b, 148b, 151b, 152b, 153b, 154b, 155b, 157b, 165b, 166b, 167b, 170a, 171b, 173b, 174b, 175b ..... Genus : Achnanthes</p> <p>Description : Achnanthes cells are heterovalvar, having a raphe seen with one valve, another valve with a pseudoraphe. Has a cell length of 5–35 µm and a width of 3–10 µm. There are 2 chloroplasts shaped like plates in the middle of the cell. This species is widely distributed to various surfaces that flow in the water. Rectangular to elliptical cells in the valve display are bent (genuflexed).</p>		

6	<p><i>Gomphonema</i> sp.</p>	<p>Divisi : Thallophyta            Classis : Diatomeae            Ordo :            Cymbellales            Famili :            Gomphonemataceae            Genus :            Gomphonema            Spesies:  <i>Gomphonema</i> sp.</p> <p>Sumber : <a href="http://www.algaebase.org">www.algaebase.org</a></p>	 <p>(A) dokumentasi pribadi            (B) <a href="https://microscopesandmonsters.files.wordpress.com">https://microscopesandmonsters.files.wordpress.com</a></p>
<p>Key determination :            126a, 127b, 139b, 144b, 145b, 147b, 148b, 151b, 152b, 153b, 154b, 155b, 157b, 165b, 166b, 167a, 168b, 169b ..... Genus : Gomphonema</p> <p>Description :            Gomphonema is a large genus with more than 400 taxonomies and is distributed throughout the world. Most of these species produce mucopolysaccharide stems that are secreted through the apical pore plane. Gomphonema cells are heteropolar. Usually this species is abundant in freshwater waters. On the surface of the Gomphonema valve there is a clear striae, the upper valve is at least dilated. The shape of the cell is round or rostrate. There is a single stigma in the central area and a single H-shaped chloroplast with central pyrenoids. From the results of other studies say some species of Gomphonema are sensitive to pollution. Gomphonema species are cosmopolitan, wide distribution especially in tropical region (Reichardt, 2015).</p>			
7	<p><i>Euglena viridis</i></p>	<p>Divisi : Thallophyta            Classis :            Euglenophyceae            Ordo : Euglenales            Famili :            Euglenaceae            Genus : Euglena            Spesies: <i>Euglena viridis</i></p> <p>Sumber : <a href="http://www.algaebase.org">www.algaebase.org</a></p>	 <p>(A) dokumentasi pribadi            (B) <a href="https://belajarbarengmasradian.wordpress.com">https://belajarbarengmasradian.wordpress.com</a></p>

	<p>Key determination : 1b, 3b, 56b, 68b, 106a, 107b, 108a, 109a, 110b, 111b, 112a ..... Genus : Euglena</p> <p>Description : Cylindrical or fusiform cells and often show metabolism. Euglena cells live solitary and free. They are usually elongated but can be spindle or twisted. The shape of the disc or stellate depends on the species. Has flagella that arises from the apical reservoir. Can be found in shallow waters or acidic waters. Some euglena can cause taste and smell in drinking water. Most species appear green, but the green in some species is covered by a red pigment called haematochrome. The amount of chloroplasts ranges from one to many with or without pyrenoids. Euglena is found in calm water, ponds and lakes, especially in waters with high organic nutrition with a low pH of 0.9 to a high pH of 8.0. Euglenids has different mode of nutrition i.e. phagotrophy and photoautotrophy (Leander, Lax, Karnkowska, &amp; Simpson, 2017).</p>	
8	<p>Cymbella tumida</p>	<p>Divisi : Thallophyta Classis : Diatomeae Ordo : Cymbellales Famili : Cymbellaceae Genus : Cymbella Spesies: <i>Cymbella tumida</i></p> <p>Sumber : <a href="http://www.algaebase.org">www.algaebase.org</a></p> <div data-bbox="758 730 1260 1093">  </div> <p>(A) dokumentasi pribadi (B) <a href="http://cfb.unh.edu">http://cfb.unh.edu</a></p>
	<p>Key determination : 126a, 127b, 139b, 144b, 145b, 147b, 148b, 151b, 152b, 153b, 154b, 155b, 157a, 158a, 159b, 160b, 161b, 162b, 164b ..... Genus : Cymbella</p> <p>Description : Cymbella is the most diverse genus. A cell with a soft curved dorsal surface. The central raphe bends down (towards the ventral surface) and the polar end curves upward (towards the dorsal surface). Cymbella cells have a dorsal convex and straight, concave or slightly convex ventral margin. Raphe goes to the center with the outer end rotating upward towards the dorsal margin and the center end facing downward below the ventral margin. There is a single H-chloroplast, and has a single pyrenoid. The surface of the valve with the striae at the right corner towards the raphe. Cells 10–260 µm in length and width 4–50 µm. Cells can live freely or be attached with mucus pads to a strong substrate. It can grow open water treatment filters and reach a considerable amount, thus causing blocking of problematic filters.</p>	

<p><i>Oscillatoria</i> sp</p>	<p>Divisi : Thallophyta          Classis :          Cyanophyceae          Ordo :          Oscillatoriales          Famili :          Oscillatoriaceae          Genus : <i>Oscillatoria</i>          Spesies: <i>Oscillatoria</i> sp.          Sumber : <a href="http://www.algaebase.org">www.algaebase.org</a></p>	 <p>(A) dokumentasi pribadi (1000 x)          (B) <a href="http://www.writeopinions.com">http://www.writeopinions.com</a></p>
<p>Key determination :          4b, 43a, 44b, 46b, 53b, 54a ..... Genus : <i>Oscillatoria</i></p> <p>Description :  <i>Oscillatoria</i> is a cyanobacterium that is filamentous and colonized. Oscillators can move back and forth with each other to the light source. Sunlight is needed for photosynthesis to survive and reproduce by fragmentation. This species forms a long filament of cells which can break down into fragments called hormogonia. This hormone can grow into a long, new filament. Having trichomes consisting of rows of cells. Trichomes are straight or bent and are single or group. The tip of the trichome oscillates like a pendulum. The life is planktonic or benthic or attached to a rocky substrate. Cell width 1-60 µm, narrow cell wall or not depends on species. species do not have caliptra in the final cell of trichomes. The final cell is rounded so that it does not have a distinctive shape.</p>		
<p><i>Ankistrodesmus</i> densus</p>	<p>Divisi : Thallophyta          Classis :          Chlorophyceae          Ordo :          Sphaeropleales          Famili :          Selenastraceae          Genus :  <i>Ankistrodesmus</i>          Spesies:  <i>Ankistrodesmus</i> densus          Sumber : <a href="http://www.algaebase.org">www.algaebase.org</a></p>	 <p>(A) dokumentasi pribadi          (B) <a href="http://protist.i.hosei.ac.jp">http://protist.i.hosei.ac.jp</a></p>
<p>Key determination :          1b, 8b, 13b, 30b, 52b, 53a, 54b, 58b, 61a, 62a ..... Genus : <i>Ankistrodesmus</i></p> <p>Description :          Cells are solitary and cluster and some spin spirally with each other. They do not have mucus and needles (crescentshaped) or are slightly pointed towards each end, sometimes straight and usually curved. Having a parietal chloroplasts and some having or not having pyrenoid. Found in phytoplankton from ponds and lakes and metaphyton from ditches, ponds, lakes (wehr books). Also found in slow flowing rivers or more acidic waters. But in this study found in seawater with conditions that do not have chloroplasts. cell width 1-5 µm and length 20-165 µm.</p>		

## CONCLUSION

From the results of the study found as many as 12 species from 4 families namely Bacillariophyceae, Chlorophyceae, Euglenophyceae and Cyanophyceae. Of the four families produced 12 species including *Navicula sp.*, *Euglena viridis*, *Spirulina sp.* and *Oscillatoria sp.* It indicates that the environment is still good.

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