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MORPHOLOGY AND SAND CHARACTERISTICS AT FIVE RECREATIONAL BEACHES IN PAHANG

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Abstract: Pahang coastline stretched approximately 209 km long in the east coast Peninsular Malaysia and blessed with varying width. The coastal zone provides many recreational beaches, attracting an estimated of 600 thousand visitors per annum. These beaches had become familiar attraction for tourism and recreational activities. Despite that, tourism activities shed positive economic value to the locale, the ecological status of the recreational beaches are now in alarm. The attraction along the coastal zone will be negatively influenced should the beaches are harmed due to the ongoing anthropogenic activities. Following a preliminary visual survey of approximately 20 beaches located in the three regions alongside the coastline, namely north (Kuantan), middle (Pekan) and south (Rompin), 5 sites were selected for the study site. Beach profiles, sediment samples, and tide characteristics were collected at each site in two different periods; late northeast monsoon and inter-monsoon. The beach morphology analysis found that, the beach tends to be narrower in the centre and gradually becomes wider in the northern and southern stretches. The changes in width suggest that the effect of headland and pocket beach characteristics on the hydrodynamic movement and sediment transport activities. The variations of beach's slopes were also observed to be from a few degrees up to more than 45 degrees. Analysis of sediment grain size distribution was performed using GRADISTAT. The sediment samples were classified according to their mean, sorting, skewness and kurtosis values. Results indicated that most sites are classified as medium sand, poorly sorted, hold a negative skewness and dominated by mesokurtic and leptokurtic. Finally, results are compared to previous works done along Pahang coastline to validate the significant contributing factors that affect the sediment characteristics and beach width.

Keywords: Pahang coastline, sediment grain size analysis, beach morphology, GRADISTAT.

Introduction

In theory description, beaches are form as depositional unit that are well developed between the low water line (low tide) and high-water line (high tide). According to Ariffin *et al.* (2019), beach is defined as a structure that formed by influence of wave, wind and tides. Beach environment consists of predominantly by pebble or sandy shore especially in the area between high and low water marks of the sea. Bird (2000) described that, about 40% of the world's sands are made of non-consolidated sediment and gravel and over 20% are commonly found with sandy beach environments. Sandy beaches are generally long and straight with abundant supply of sediment supply that varies greatly in size. Previous researches have been done in order to understand the natural process of morphology and morphodynamic of sandy beach environments for decades. Despite the variety of sandy beach morphologies identified around the globe, they all share one similar characteristic which is providing the public with recreational and tourist areas. Wide open beach with a combination of shade and growing trees on the upper shore offer ranges of recreational activities such as swimming, surfing, and picnicking among beach goers and holiday makers. However, the suitability of sandy beach for recreational purposes may be differ between places and it is essential to understand the influence of beach characteristics in making certain type of sandy beach suitable to be used as recreational area. Among the characteristics include beach width and slopes, wave climate, tidal range and grain size. Shorelines at different latitudes come with different climate wave. Wind-driven wave energy and height influenced the nearshore bathymetry, and depth play important roles in shaping the beach landscape. Higher wave energy would result in coarser sand distribution while dune areas (upper part of high tide) usually consist of finer grain sand derived from wind-blown across the beach. The sediment distributions along the beach are also influenced by tide environment. Micro, meso and macro tidal environments determine to what extent a beach will be submerged and exposed at different times throughout the day. All these various physical factors contribute to the varying grain size distribution along the beach (Kasper-Zubillaga & Carranza-Edwards, 2005; Carranza Edwards *et al*., 2009). Human-induced activities such as beach nourishment and sediment entrapment could also contribute to the grain size for beach stability against erosion and developments. Grain size distribution is commonly used in sedimentology study in modern sediment analysis to indicate sedimentary environment (Dickinson, 1974; Ingersoll, 1990) and dynamic of sediment transport process (Le Roux & Rojas, 2007; Vandenberghe, 2013). Grain size can also determine the slope of the beach. The grain size distribution parameters are divided into four major groups; mean, standard deviation (sorting), skewness and kurtosis. These parameters are obtained from mathematical and graphical methods. According to an earlier study which was done by Krumbein and Petijohn (1938), the mathematical "method of moments" is the most accurate method as it represents the entire sample population. This paper aims to study the relationship between sand characteristic and beach morphology, beach profile and beach slope at five selected recreational beaches along Pahang coastline.

Methodology

Study Area

Malaysia consists of two regions, Peninsular Malaysia at the west and Sabah and Sarawak at the east, separated by South China Sea. Peninsular Malaysia has 1,972 km long of coastline while Sabah and Sarawak's stretch for approximately 2,837 km. In this study, the focus would be mainly in Peninsular Malaysia, particularly in the east coast region. Within a year, two major monsoons; which are the southwest monsoon (May to September) and northeast monsoon (November to March); brings wind and heavy rain to the west and east coast Peninsular Malaysia, respectively. There is an inter-monsoon transition period between these two periods. This inter-monsoon occurs in two different months (April and October). The west coast and east coast of Peninsular Malaysia have different sediment characteristic. For the west coast of Peninsular of Malaysia, most sediment characteristic along the coastline is dominated by mud flat. This is supported by the coverage of mangrove belt at about 72% of the stretch. The sandy beaches on the west coast of Peninsular Malaysia can only be found at rocky headland, which is composed by granite and sandstone. For the east coast of Malaysia, most of the beaches are sandy sand coming from the main rivers and streams, such as Kelantan River, Terengganu River, and Pahang River. Beach width is the term that is used to describe the distance between vegetation area at high tide level and low water line at low tide level. The beach width, beach topography beach slope and sand characteristic along Pahang coastline varies as being described in previous studies (Wong, 1981; Rosnan *et al*., 2010; Zaini, 2011; Azman Azid, 2015; Zaini *et al*., 2015). This is because the beach width is usually influenced by erosion and deposition processes that lead to the changes of beach steepness and width (Dora *et al*., 2012). Along Pahang coastline, major vegetation areas observed are mangrove swamp and beach forest (Casuarina). These Casuarina trees act as wind barrier which provides shade in landscaping and recreational facilities of resort such as nature trail. The mangrove swamps usually located near to estuaries have played an important role as coastal barrier, eco-tourism, and eco-educational purpose. According to Rosnan *et al*., (1995), east coast of Peninsular Malaysia is influenced by two types of tides; diurnal and semidiurnal. Diurnal tides are described as giving one high and one low water level a day. Semi diurnal is giving two high and two low water level a day. For Pahang waters, they are considered as semidiurnal tide throughout the year. The tidal range of Pahang coastline is about 1.5 – 2.2 m and is categorised as mesotidal as based on Hayes (1979). Pahang Darul Makmur is a state located in the east coast of Peninsular Malaysia with its coordinate from Chendor, border Terengganu and Pahang (4°10.575'N, 103°25.165'E) to Kuala Rompin border Pahang and Johor (2°39.612'N, 103°37.794'E). Pahang is the third largest state in Malaysia after Sarawak and Sabah and being the largest state in Peninsular Malaysia. The total land area is approximately 35,840 km^2, whereas beach stretch is as far as at approximately 209 kilometres from north to south. Currently, there are 11 regional districts in Pahang; Kuantan, Pekan, Rompin, Bera, Bentong, Cameron Highlands, Jerantut, Lipis, Maran, Raub, and Temerloh. The first (3) three districts are facing the South China Sea that are exposed to strong winds and high waves

Figure 1: Map of study site

during northeast monsoon, and in this study, the recreational beaches along Kuantan region is selected for data collection.

Data Collection

The study area consists of five sites, and being divided into three zones: Zone A (site 1 and site 2), Zone B (site 3) and Zone C (site 4 and site 5) as shown in Figure 1 which coordinate (latitude and longitude) of each station were recorded using Garmin 62S Global Positioning System *(*GPS). All of the coordinates were tabulated in Table 1. The data were collected during the field works which were being carried out in late

Table 1: GPS coordinates for the location of study area site 1 to site 5

Sites	GPS Coordinates		location
	Latitude (N)	Longitude (E)	
1	3.924°	103.373°	Balok
2	3.885°	103.366°	Batu Hitam
3	3.697°	103.339°	Teluk Cempedak
4	3.751°	103.326°	Kempadang
5	3.812°	103.372°	Sepat

northeast monsoon (late March 2018 until early April 2018). The distance between the first sites (Balok) to the last sites (Sepat) is about 31 km. The distances between each of the sites are set in irregular interval. In this study, two analyses were carried out; (1) beach morphology survey and (2) sediment characteristic analysis (sediment grain size). For beach morphology survey, in-situ survey was conducted using transit set. Sediment samples were collected at each site's different environment and later analysed in the laboratory using dry sieving method.

Beach Morphology Survey

Beach morphology survey was carried out twice in March 2018 and April 2018. The survey was conducted using Leica Builder 409 equipped with a prism to record and calculate the distance and angle. The survey data was conducted from high tide water level near vegetative area up until surf zone area near low water line during low tide condition. The underwater morphology in the surf zone about 1 meter depth was also recorded using the same techniques and instruments. The points of each transect at surf zone location was set in irregular interval after due consideration of the influence from the wave conditions. The total lengths of shoreline covered in the study were approximately 400 m with 20 m interval at each transect for each site as illustrated in Figure 2. The points of each transect were not consistent as we follow the beach topography, whereas more points were allocated for gaps between different elevations and lesser points for long flat stretches. Data from the total station that contain x, y and z-axis were imported and processed using topographic software Surfer (Golden Software) to produce three dimensional (3D) graphic interpolation. The interpolation process uses kriging algorithm to generate digital elevation model (DEM) that convert each surveyed point into continuous field grid profiles.

Beach Width and Beach Slope

Beach width was determined by using measuring tape from high tide level near vegetative area to low tide level at the low water line. Beach angle is known as the gradient of the beach that gives an overview of changes on the beach steepness and slope. Beach angle was obtained based on calculation of height and width within the beach profile at the measured beach site (Dora *et al*., 2012). Basically, the beach angle was adopted from basic right-angle triangle trigonometric formula as shown below:

$$\sin\theta = \frac{H}{W} \qquad (1)$$

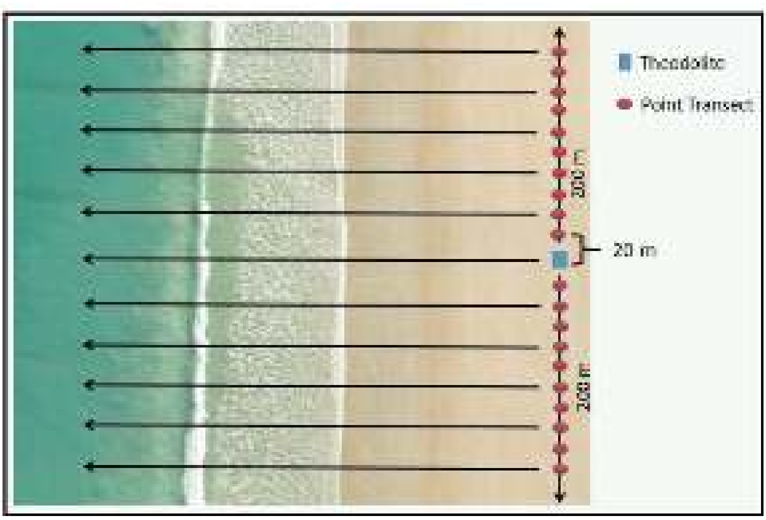


Figure 2: Point transect for beach profile

$$\theta = \sin^{-1}\frac{H}{W} \tag{2}$$

Where, degree of beach angle, H is the height or elevation (m) of beach profile and *W* is the beach width (m).

Sedimentological Characteristic

Dry sieving method was used in this study to give more insight about sediment grain size. This method is widely used by researchers to classify sediment characteristic. According to Rosnan and Zaini (2010), dry sieving is used to explain dynamic movement of sediment transport in a study area. 30 sediment samples from five different beaches were collected and analyse at three different tidal levels namely high-tide (HT), middle-tide (MT) and low-tide (LT). In the laboratory, the sediment samples were set in oven dried at a temperature range of 60^{o}C to 70^{O}C for 24 hours followed as Chauhan (1990). In this study, dried sieving method was chosen simply because only the "coarser" fraction sediments were obtained (grain size > 63 µm). First, 200 g of each sediment samples were weighted and sieved using mechanical shaker machine. This shaker has 13 different mesh sizes in millimetre (mm) unit of 4.0, 2.8, 2.0, 1.4, 1.0, 0.71, 0.5, 0.355, 0.25, 0.18, 0.125, 0.09 and 0.063. Sediment samples retained at each mesh were weight using electronic balance. The analysis statistical parameter for grain size distributions were calculated using computer software namely GRADISTAT (Blott and Pye, 2001), in order to calculate the grain size distribution (mean, sorting, skewness, and kurtosis) in term of metric unit (arithmetically and geometrically) and phi unit, (logarithmically). As proposed by Folk and Ward (1957) method of moment, Mean (X), is an indicator for parameter which give the average size of sediment. The mean parameter can be calculated as follow:

Mean,
$$X\phi = \frac{\phi16 + \phi50 + \phi84}{3} \tag{3}$$

Where, 16, 50 and 84 represent the size at 16, 50 and 84 percent of the sample weight. In other word, 84 is the average mean size of finer third and 16 is the average mean size of the coarser third. According to Folk and Ward (1957), these mean values are as twice more accurate compared to the moment mean (X). Standard deviations (Sd) are known as sediment sorting in the study of grain size distribution. This standard deviation can be calculated (Folk and Ward, 1957) as follow:

Standard deviation,
$$Sd\phi = \frac{\phi84 - \phi16}{4} + \frac{\phi95 - \phi5}{6.6} \tag{4}$$

Where, 84, 16, 95 and 5 are phi value at 84, 16, 95 and 5 percentiles.

Skewness refers to statistical analytics is the focuses on symmetrical distribution of the sediment that has finer or coarser particles. For skewness, two samples may have similar grain size and sorting but different in their symmetry. As proposed by Folk and Ward (1957) the skewness can be calculated as follows:

Skewness,
$$Sk\phi = \frac{\phi84 + \phi16 - 2\phi50}{2(\phi84 - \phi16)} + \frac{\phi95 + \phi5 - 2\phi50}{2(\phi95 - \phi5)} \tag{5}$$

Where 84, 16, 50, 95 and 5 were obtained from direct reading from respective Percentiles. The symmetrical curve has 0.00 reading for the normal distribution graph and indicates sediment samples as positive skewed or negative skewed based on fine or coarser particles respectively.

While kurtosis indicates the peaknesss and flatness of the sediment samples which follows,

Kurtosis,
$$KG\phi = \frac{\phi95 - \phi5}{2.44(\phi75 - \phi25)} \tag{6}$$

Where 95, 5, 75 and 25 are from percentage that same as sorting and read from cumulative graph directly. The normal distribution for kurtosis is 1.00 and any reading that deviate from the value are classified in six different classes which are very platykurtic (less than 0.67), platykurtic (0.67 to 0.90), mesokurtic (0.90 to 1.11), leptokurtic (1.11 to 1.50), very leptokurtic (1.50 to 3.00) and extremely leptokurtic (more than 3.00).

Results and Discussion

Beach Morphology

For each study site, beach width and slope gradient are observed to be distinguished. The findings on the approximately beach width and beach slope are shown in Table 2. The approximate value for beach width from site 1 to site 5 are 168.4 m, 99 m, 57.3 m 78.1 m and 116.1 m respectively. For beach slope, the ranges are between 0.82° to 1.26° from site 1 to site 5 respectively. The beach is wider on the **Zone A** stations (site 1 and 2,) towards **Zone C** stations (site 4 and 5) but narrower at the **Zone B** station (site 3).

According to study by Zaini (2011) along Pahang coastline, he had classified beach width in three different major groups consisting of narrow (< 50 m), intermediate (50 – 100 m) and wide (>100 m) beach. In this study, only two major groups of beach width classification (intermediate and wide) are fulfilled. Site 3 and 4 belongs in the intermediate group while site 1, 2 and 5 are classified as wide. Even though site 3 is classified as intermediate beach width in Zaini (2011), the beach has lesser width value compared with the other four sites. From our observations, variations in beach width are commonly related to the surrounding boundary conditions of the coastal area and by hydrodynamic forcing of waves and tides (Castilhos & Gre, 2006). Boundary conditions that influence the beach morphology and morphodynamic are commonly changing with developments in the area of large amount of recreations and anthropogenic infrastructures. From Table 2, sloping profile of Site 1 to Site 5 indicate the characteristic of sandy beach environments commonly used for recreational purposes. These include beach space, nearshore bars, swash bars, rip channels, rocky headland or "pocket beach" as shown in Figure 3 and 4. According to Mustafa *et al*., (2007), sandy beach morphology is known to be highly dynamic, with seasonal monsoon being one of the major controls in contributing to a rapid adjustment of transported sediment. However, beach slope at site 3 was observed to be different compared to the other sites with the beach slope reaching up to more than 30 degrees shown in Figure 5(c). Site 3 (Teluk Cempedak) which located between the headlands of Tanjung Pelindung Tengah and Tanjung Tembeling is referred as a pocket beach, while the other beaches slope ranging between 15 to 25° slope. Historically, with downstream coming from Sungai Cempedak, this site has been affected with a very severe erosion (average retreat rate: -0.8 m/y). Beach nourishment has been adopted to prevent further loss of beach space, thus increasing the added sand volume.

Table 2: Approximately beach width and beach slope from Site 1 to Site 5

Location	Sites	Beach width (m)	Beach slope (°)
Balok	1	~ 168.4	~ 0.82
Batu Hitam	2	~ 99	~ 1.79
Teluk Cempedak	3	~ 57.3	~ 3.28
Kempadang	4	~ 78.1	~ 1.82
Sepat	5	~ 116.1	~ 1.26

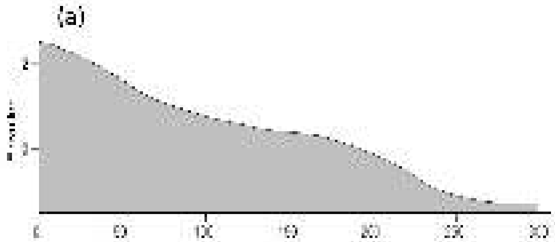
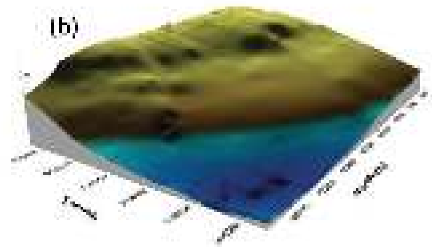
Site	2-Dimension (2D)	3-dimension (3D)	In-situ Pictures
1			

Figure 3: The two dimension (2D), three dimension (3D) and visually identified beach features at low tide: (c and d), wide sandy beach at Site 1 view to North with exposed beach rock and South respectively. Distance and elevation are measure in meter (m).

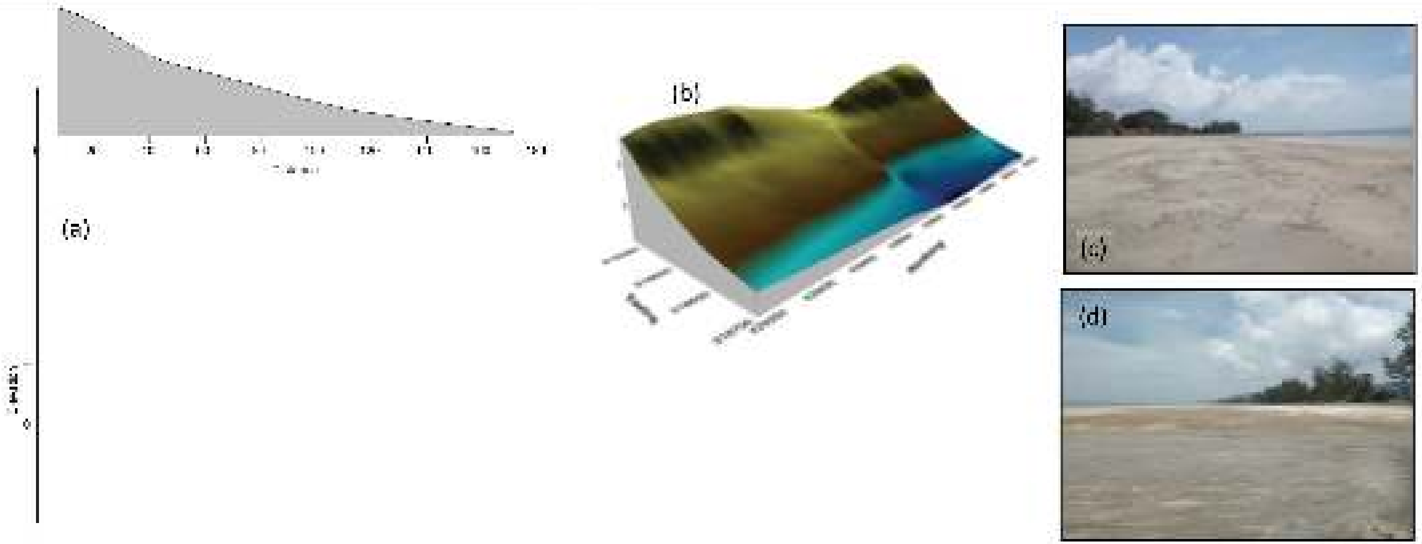
Site	2-Dimension (2D)	3-dimension (3D)	In-situ Pictures
2			

Figure 4: The two dimension (2D), three dimensions (3D) and wide sandy beach with black stone barrier at north part (c) of beach at Site 2. Distance and elevation are measure in meter (m).

Site	2-Dimension (2D)	3-dimension (3D)	In-situ Pictures

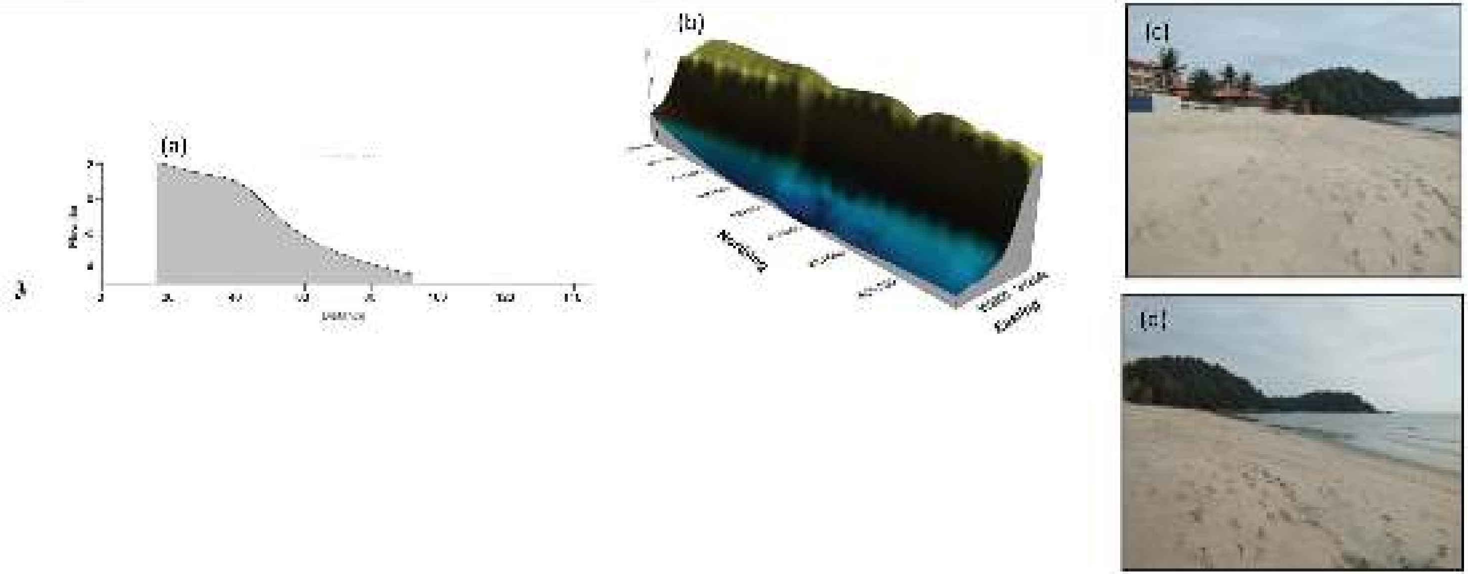


Figure 5: The two dimensions (2D), three dimension (3D) and wide sandy beach at Site 3, view from northern part (c and d). Distance and elevation are measure in meter (m).

Site	2-Dimension (2D)	3-dimension (3D)	In-situ Pictures
4			

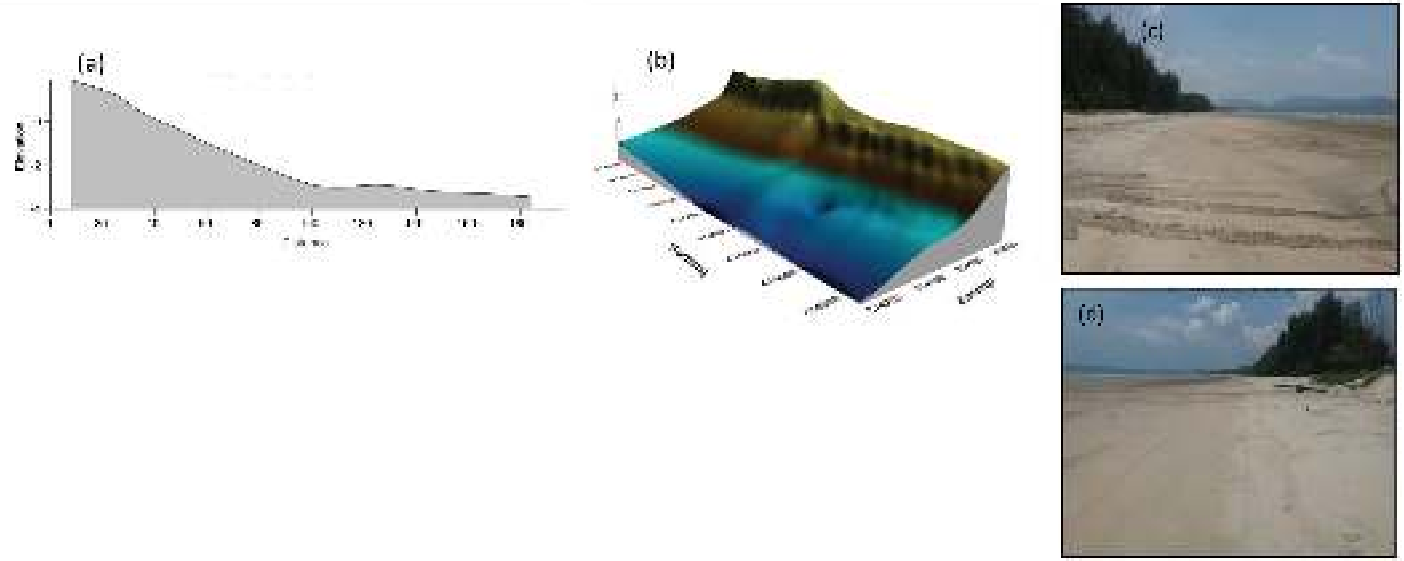


Figure 6: The two dimensions (2D), three dimension (3D) and wide sandy beach at Site 4, view from northern and southern side, respectively. Distance and elevation are measure in meter (m).

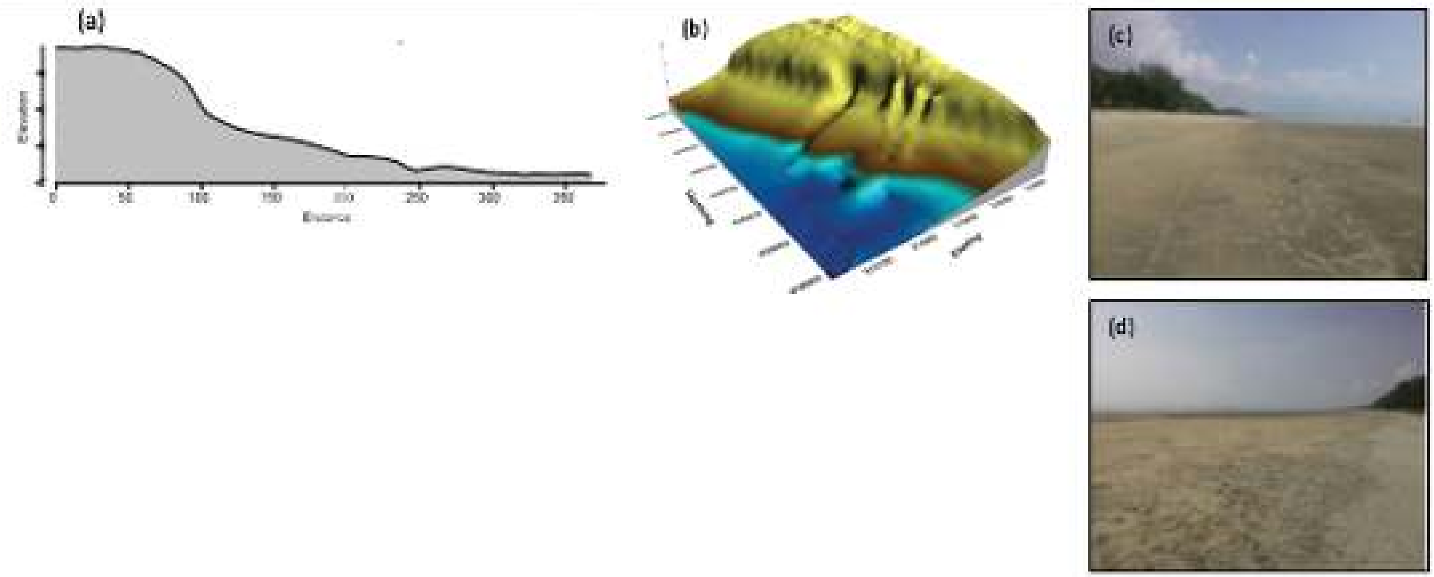
Site	2-Dimension (2D)	3-dimension (3D)	In-situ Pictures
5			

Figure 7: The two dimensions (2D), three dimension (3D) and wide sandy beach at Site 5, view from northern and southern side, respectively. Distance and elevation are measure in meter (m).

Sedimentary Characteristic

All the statistical data were tabulated as in Table 3 and plotted in the bar chart and pie chart shown in Figure 8 and Figure 9 respectively. Analysis of mean value was used in this study to determine the average grain size of sediment. According Blott and Pye (2012), there are standard sizes for sand that define as fine, medium and coarse sand. The size ranging between 63µm to 250µm is fine sand, 250µm to 500µm is medium sand and 500µm to 1mm is coarse sand. In Figure 8(a), most sites were revealed to be medium sand, followed by fine and coarse sand with the values of 50%, 40%, and 10% respectively. These similar predominantly trend of medium and fine sand were also observed in Ronan (2010). In his work, beach sediment along Pahang coastline from Cherating to Nenasi consist of medium to fine sediment size and that east coast Malaysia is dominated by medium and coarse sediment. However, Azman Azid *et al*., (2015), mentioned in their study which took place along Tanjung Lumpur to Cherok Paloh, that most of the sediment grain sizes in that along the area are coarser with medium sand. The reasons are likely caused by the difference in sea level, wave energy and nearby source of alongshore sand between the two monsoons. Sediment size is important in the interaction of sand particle with oscillatory flow in the wave bottom boundary layer where most morphological changes happened. Variations in particle size and shape would influence the behaviour of the interaction and the transport characteristics. Complex interactions in the medium sand regime usually associated with different visible features as beach cusp and ripples during calm season and flatbed under stormy weather commonly noted in Figure 3 (b) to Figure 7 (b). In Table 2, beach slope and grain interactions can be observed which implies the influence of physical processes (waves, tides, currents and sediment transport) that controlling the equilibrium state of the beach face and shoreline evolution.

Sorting analysis or standard deviation was used to identify the measured grain size variation that consists of the largest part of the size distribution. Sorting value helps in reconstructing the sedimentation history of detritus. Most of the samples had poorly sorting, followed by well sorted, moderate sorted and moderately well sorted, very well sorted with values of 40%, 20%, and 10%, respectively as shown in Figure 9 (b). Similar trend of poorly sorted regime that dominating Pahang coastline was observed in Azman Azid *et al.*, (2015). According to Rosnan *et al*., (2009), poorly sorted sediments are commonly indication of erosional process which is the main factor in the narrowing of beach area. However, discussion on erosion or accretion will not be discussed in this paper. Furthermore, poorly sorted sediments demonstrate the high impact range of physical forces (wind and wave) that act onto the beach area which control the sediment distributions (Dyer, 1985). For well-sorted sediments, the results suggest the influence of the environmental conditions are the same as poorly sorted sediments but are found to be varied throughout different seasons. Different seasons may bring various degrees of impacts that could consistently alter the sediment distribution along the shoreline. Finally, very well sorted sediments are the result at temporal scale of continuous high wave activities to sediment interactions over a period.

Skewness refers to the symmetrical distribution of the sediment samples that composed of fine or coarse fraction. The positive skewness mainly associates with fine particle while the negative skewness indicates coarser particle (Rosnan *et al*., 2009). Most of the collected samples were coarse skewed and symmetrical that has a similarity value of 40%. In overall, results show negative skewness for the sediment sample distribution. The trend of skewness shows similarity with previous studies in Zaini (2011) and Azman *et al*. (2015) which their study areas were also based along Pahang coastline. Even though the result is negatively skewness (coarse particles), the overall mean of grain size along the study areas are still in medium size as in Azman *et al*. (2015). This result is supported by Rosnan *et al*.,

(2003), which stated the cause of the negative skewness distribution is likely to occur due to physical factors such as the frequency of wave and current actions act on the beach. Kurtosis analysis was used to determine the peaks and flatness of collected sediment samples. Most of the sediment samples along the study sites were dominated by mesokurtic to leptokurtic with ratio 50% and 20% respectively. Some of them were platykurtic, very leptokurtic and very platykurtic with each having a 10% value. Compared to study by Azman Azid *et al*., (2015), a similar trend of mesokurtic and platykurtic can be observed. However, the case was different in Rosnan *et al*. (2010) and Zaini (2011), where the kurtosis characteristics along Pahang coastline were observed more dominated by leptokurtic class. According to Jaquet and Vernet (1976), when kurtosis results show a major tendency towards certain elements (mesokurtic and leptokurtic), the sediment samples may have more than one population and in unequal amount. Under the same assumption, mesocratic class is observed to populate by half of the sediment sample population compare to other classes. In this study, high value of kurtosis might be influenced by the settlement of sediment which already achieving their equilibrium sorting prior to the study sites that experience high energy environment as mentioned in Friedman (1961).

Where,

Mean,

FS = Fine Sand
MS = Medium Sand
CS = Coarse Sand

Sorting,

WS = Well Sorted
PS = Poorly Sorted
MWS = Moderately Well Sorted Sand
MS = Moderately Sorted
VWS = Very Well Sorted

Skewness,

S = Symmetrical
CS = Coarse Skewed
VCS = Very Coarse Skewed Sand

Kurtosis,

VL = Very Leptokurtic
VP = Very Platykurtic
M = Mesokurtic

Conclusion

The coastal morphology survey along the selected recreational beaches within the Pahang coastline is found to be narrower at the middle and wider towards northern and southern stretches. This study had analysed over 30 sediment samples from five different beaches along Pahang northern region and shows that most area consists of medium sand followed by fine sand and coarse sand. The poorly sorted sediment type is dominant followed by well sorted, moderately sorted,

Table 3: Sedimentological characteristic value for March and April 2018

SITE	MEAN		SORTING		SKEWNESS		KURTOSIS	
	MARCH	APRIL	MARCH	APRIL	MARCH	APRIL	MARCH	APRIL
1	2.769 **FS**	2.731 **FS**	0.427 **WS**	0.269**VWS**	-0.107 **CS**	-0.176 **CS**	1.839 **VL**	1.462 **L**
2	1.122 **MS**	1.829 **MS**	1.624 **PS**	1.111 **PS**	-0.051 **S**	-0.455 **VCS**	0.666 **VP**	0.712 **P**
3	0.824 **CS**	0.998 **MS**	0.664 **MWS**	1.410 **PS**	-0.088 **S**	-0.065 **S**	1.166 **L**	0.979 **M**
4	1.578 **MS**	2.269 **FS**	0.999 **MS**	0.791 **MS**	-0.078 **S**	-0.547 **VCS**	1.001 **M**	1.061 **M**
5	2.519 **FS**	1.369 **MS**	0.492 **WS**	1.134 **PS**	-0.214 **CS**	-0.136**CS**	1.076 **M**	0.935 **M**

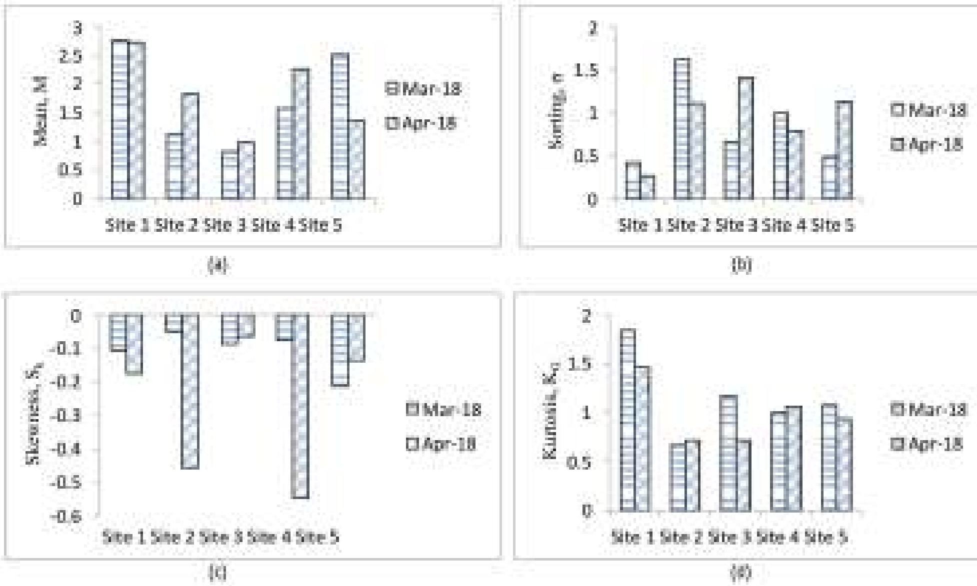


Figure 8: Grain size distribution at 5 recreational beaches along Pahang coastline. **a**) mean, **b**) sorting, **c**) skewness, **d**) kurtosis.

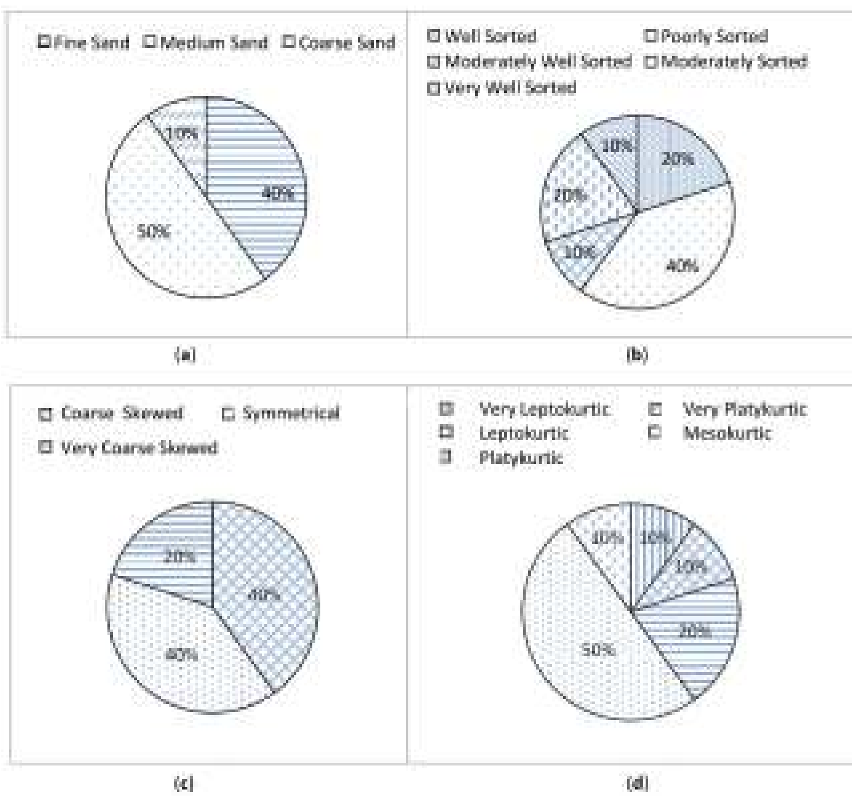


Figure 9: Overall of grain size distributions at 5 sites of recreational beaches along Pahang coastline. **a**) mean, **b**) sorting, **c**) skewness and **d**) kurtosis.

moderately well sorted and very well sorted. Moreover, the sediment sample distributions show negative skewness which indicates coarse skewed and very coarser skewed followed by symmetrical. Finally, mesokurtic and leptokurtic represent most of the sediment's kurtosis. Natural factors such as wind, wave and tide are found contributing to the beach width morphology and sediment size characteristics along the study sites. The reason may relate to the location of east coast Malaysia that facing directly to the South China Sea, receiving high wave energy and strong wind blow during northeast monsoon and the transition monsoon period. The relationship between sediment characteristic and beach morphology are commonly associated with local setting. The result of present study has its important insight on beach management of coastal zone and the protection of surrounding areas. It is also a continuous study in preserving other function such as nature, recreation and tourism along Pahang coastline. Hence, a long-term monitoring and data is necessary to understand the relationship at these recreational beaches.

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