

Role of Bionik in product development

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Abstract

Product development is a very interesting discipline especially when it can have economical value and a big demand in the market. There are many methods in developing products. One of the method is called "Bionik" as abbreviation of "Biologie und Technik" (in German language) which means "Biology and Technique". By this method the products will be developed by observing the nature. The solution can be from plants, animals or anything which exists in the nature. It is interesting to dive in and implement this method for increasing innovations in Indonesia. In this paper it will be explained how the nature can give use ideas and that what from nature is has strengthness and we should not destroy this specification but implement it for products. The stages of product development by using Bionik will be overviewed as well and some examples will be displayed such as skin structure of shark or dolphin for high speed vehicles, event the development of bullet proof material composites from natural fibers such as fibers of empty fruit bunch of oil palm (EFB), etc. The implementation of composite from EFB fibers for the armored vehicles can reduced its weight by 50 to 93% depending on the thickness of the replaced steels.

Keywords Bionik, empty fruit bunch, natural fibers, oil palm

1. Introduction

Creating a new technical product can be run through some stages as a whole process from beginning by searching an idea and furthermore as an output as sketch or product concept which will be created and then realization this idea by looking for the principle solutions through analyzing the working principles, choosing the variants related on the main principle, examining the prototype to find out if the function work and to discover what kind of phenomenon we still do not know as well until choosing the appropriate materials and the manufacturing process which will be needed and finally by producing the end product. from the sketch which were designed by the developer.

Market is the target by developing a product. No demand in market is a sad product development. There is many ways to create a new product such as shown in Figure 1. This is the reason why the market investigation is an important start for product developer. It is called market trend. Although the demand in the market can change (up or down) but the market trend is the best indicator to determine the way of the market in region, country.

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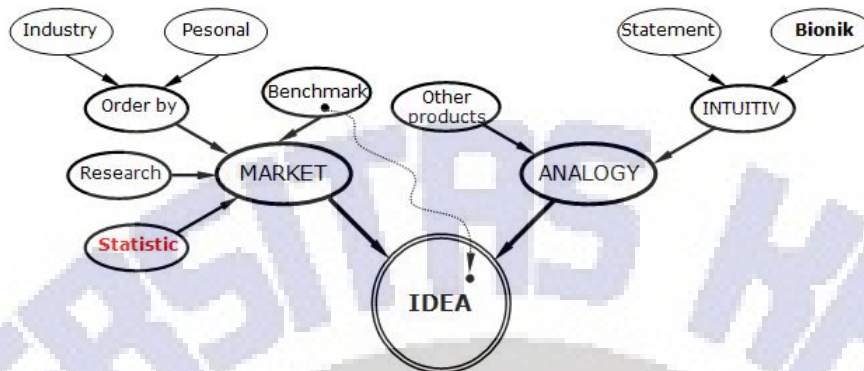
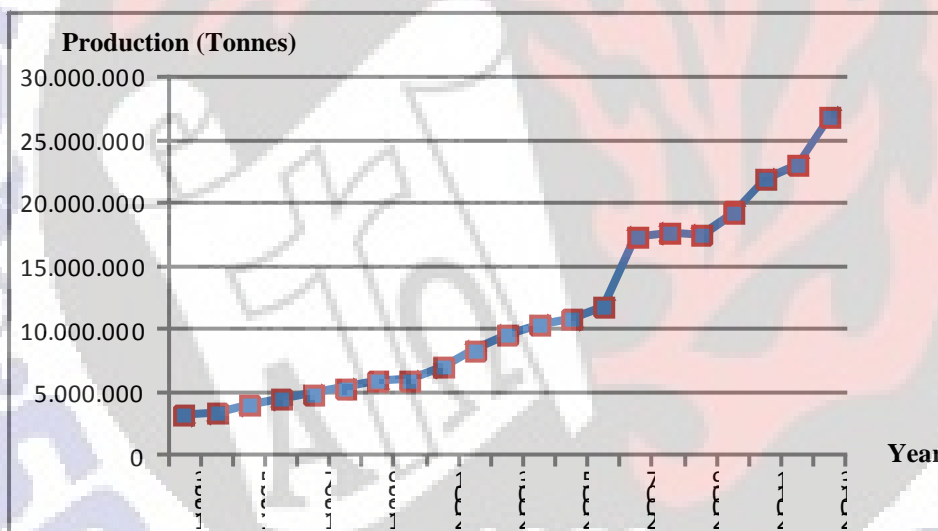


Figure 1. Methodology for finding an idea in developing a new product.

The easiest way to investigate the market trend is by using statistic. The data of any kind of statistic can be found at internet such as by FAO.org or at the official bureau such as BPS (Badan Pusat Statistik) in Indonesia. For example the production of crude palm oil (CPO) showed many years an interesting trend (see Figure 2). It means the problem in this industry can be an interesting subject to be developed.



Source: BPS, 2014

Figure 2. Production of CPO in Indonesia (1993–2013).

Related to Figure 2 the statistic explained that the product development in the field of palm oil is the wise decision since CPO production has been increasing from year to year. The problem can be at the plantation or at the palm oil.

To find out an idea in developing new product Bionik is one of the method. It is an interesting method where the developer learn from nature. The nature can adapt to the circumstances in the world already for million years, it means they all developed theirselves perfectly so that they can exist until now and it also means that the structures or constructions or principles that they use are optimized (Nachtigall, 1998; Bappert et al., 1999).

2. Materials and methods

2.1 Material

To provide the idea of Bionik the material of natural fiber which is gained from Empty Fruit Bund of Oil Palm (EFB) will be used. The EFBs are provided by a palm oil mill at Malimping, Banten, Indonesia.

2.2 Methods how to write procedures

- DIN 53 457 for 3 points bending test [10] where the test place is climated at 50% humidity, 24 0C room temperature by using climatic room equipment [DIN 53 479. (1976)]
- NA 062-08-60 AA "ISO-BIONIK" about the discipline of Bionik by DIN [NA 062-08-60 AA "ISO-BIONIK" (2011)].

3. Results and discussion

All organism such as animal, plants have optimized themselves so that they can exist until this day. The ability to survive is an interesting point which the product developer can learn and investigate. That is why their structure and construction can be implemented to technical products. As example the structure of natural fiber of Empty Fruit Bunch of Oil Palm has already the honey comb structure and it is the reason why this fiber fit to be utilized for parts in technical purposes such as for composite. Figure 3 shows the structure of EFB fiber.

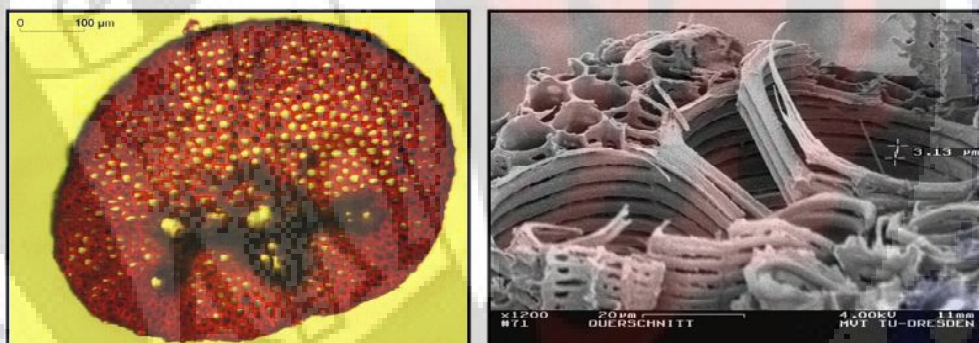


Figure 3. Corss cut of EFB fiber (Arya, 2005a,b).

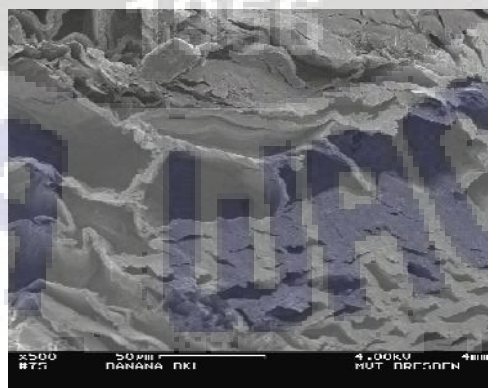


Figure 4. Cross cut of banana fiber (Arya, 2015a).

In comparison to EFB fiber there is a cross cut SEM of banana fiber. From the structure it is known that the EFB fiber has a more robust structure than banana fiber. The Modulus of Elasticity test will confirm this opinion.

So that it is important to keep the strength which is already available in nature. The chosen processing stages and the equipments can reduce the strength, the option which will be chosen as technology plays a big role on the output.

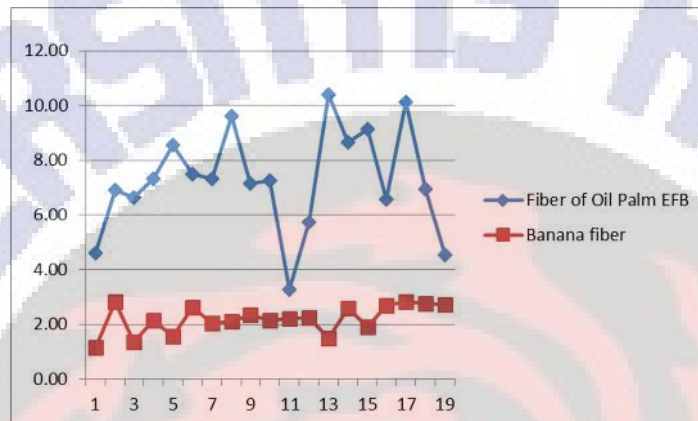


Figure 5. Modulus of elasticity of composites from natural fibers (Arya, 2015a).

If the test result to be compared with other conventional materials such as polyethylene, polypropylene, silicon carbide and steel this composite showed a profitable result that it is much lighter and has a promising strength. In Table 1, the comparison is shown.

Table 1. Density comparison of different technical materials.

No.	Material	Density (g/cm ³)
1.	PE	0.915–0.925
2.	PP	0.946
3.	Silicon Carbide	3.16
4.	Fiberglass and polyester	0.055
5.	Steel	30
6.	Composites from EFB Fibers and potato binding agent	0.4–1.2

4. Conclusion and remarks

After having the results of the Modulus of Elasticity test, a conclusion can be formulated that the natural structure of the natural fiber has a big influence on the composite's (product's) strength. That is why it is important not to destroy its structure by concerning the technology developed to produce the technical product.

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