

# STUDY ON MECHANICAL PRODUCT BASED SMALL AND MEDIUM ENTERPRISES OF BANGLADESH AND IMPROVEMENT OF A SELECTED PRODUCT

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## ABSTRACT

Small and medium Enterprises (SME) plays a vital role in the economic development of country especially in the developing countries like Bangladesh. Keeping this concept an attempt has been made to survey the SME products of Bangladesh, study and improve the qualitative performance of a selected mechanical Engineering related SME product. The most difficult part of the project was the survey portion as related project/ research paper in this field is not relatively available. With almost effort lot of information has been gathered related to different range of SME products and related factors. For study and improvement of qualitative performance of cylinder and piston used in Conchi-4 R170 engine has been selected. On study it is formed that the local product quality effort was made for qualitative improvement but due to time constraint that could not be done. In subsequent projects steps may be taken for qualitative improvement using this analysis.

**Keywords:** SME, Finance, Employee, Capital, quality assurance, Rockwell and Brinell hardness number.

## 1. INTRODUCTION

Bangladesh is an agricultural country. The this sector. If the present industrial policy of Government is implemented properly then the contribution of industrial sector especially SME's to the national economy would reach to 30 to 35 per cent and could create new 35 per cent of new employment.

Considering the prospect of SME an attempt is made in this project to survey the present situation of SME products. By this project it was tried to find the present situation of SME, its prospect, obstacles, and contribution of SME to the national economy of Bangladesh. economy of Bangladesh is mainly depending upon it. Bangladesh is a developing country. To be a developed country Industrialization is required. For this despite of being an agricultural country Bangladesh has different small, medium and large industries which need mechanical engineering related products. In Bangladesh the demand of mechanical engineering related products is quite large. To fulfill the demand every year a lot of foreign currency is spent for importing purposes of the mechanical engineering related products. The local mechanical engineering related products market of Bangladesh is mainly captured by the foreign products.

Bangladeshi products cannot complete the market due to lack of technological knowledge, proper

financial support to the producer and some other factors. To overcome the problem strong SME may be a better solution.

In Bangladesh SMEs have special significance for poverty reduction programmes and potential contribution to the overall industrial and economic growth. The contribution of SME's to the GDP is increasing due to smooth release of public loans to

This research is concerned with performance analysis of a sample SME product of Bangladesh with compare to a standard reference product. In this project it was tried to find the demand for mechanical engineering related products in Bangladesh. By surveying the small and medium organization that is producing mechanical related parts in Bangladesh and make a short list of them. By analyzing the market demand from different mechanical engineering related products one sample is chosen and it was tried to analyze their different properties & compare their quality with the foreign one and make improvement of the sample product.

From a statistics it is shown that around 34% of imported products are mechanical parts for which a large amount of foreign exchange is used. If it can reduce it will be very good for Bangladesh. After realizing the problem some institutions have come forward for the development of this sector. Government and many other organizations are working together for the betterment of this sector.

For this they can take help from the educational institutions where technological knowledge available. By their theoretical knowledge they can help the producers who have practical knowledge but do not have technological knowledge. It will also helpful for the beginning engineer to work in the later life. Realizing the problem this project has been taken.

## 2. OBJECTIVES

The main objectives of the work are-

- a) Surveying the mechanical engineering related products which are available in Bangladeshi market.
- b) Surveying the SMEs that are producing mechanical engineering related products in Bangladesh & make a list of them.
- c) Surveying the demand of both Bangladeshi & foreign product in the local market.
- d) Analyzing the demand of different products.
- e) Try to improve the quality of the Bangladeshi sample product.

## 3. EXPECTED OUTCOME

When the project was selected and started the work there were some possible outcome. They are-

- a) By surveying, it will be easy to make a list of SMEs which are related with producing mechanical engineering related products in Bangladesh.
  - b) Surveying the local market demand of Bangladeshi & Foreign mechanical engineering related products in Bangladesh.
  - c) Surveying how much foreign currency is spending for importing mechanical engineering related products in Bangladesh.
  - d) Surveying the present situation & prospect of SME in Bangladesh.
  - e) Surveying Dholaikhal area to find out mechanical engineering range products produced there.
  - f) Analyzing the market demand chose a sample product and analysis the quality of the product.
  - g) Improvement of the quality of the selected product with technological knowledge.
- At first these methods are selected randomly upon common sense. After starting the project different problems were faced. To solve that problems consulting with different books, studying different website & other paper works, consulting with experts for microstructures methodology were

changed time to time & it was decided how to improve the quality of a product.

## 4. EXPERIMENTAL RESULT:

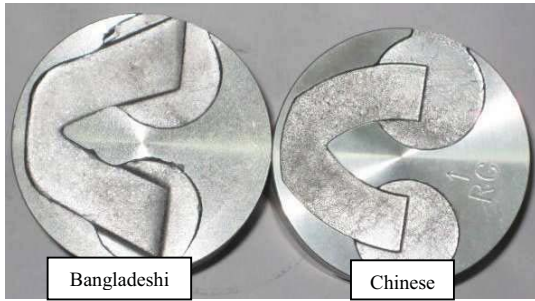
The specimen which are tested, have some difference in visualization. These visual differences clearly indicate some of the technical difference between two specimens without any testing. From figure-1 and figure-4 it is clear that visually both piston and cylinder of Chinese one were well finished than the Bangladeshi one. Chinese one was very smooth while Bangladeshi one was not so smooth comparatively. This indicates that Chinese one was made very carefully than the Bangladeshi one and also was well finished. After casting of these parts it is required to machining the parts. They also indicate that machining of Chinese one was better. For cylinder finishing of inner surface is more important than the outer surface, because piston moves in inner part of the cylinder. As well as for piston outer surface smoothness is also important. Rough surface produces heat due to friction in working condition and hence reduce the overall power produced by the engine. It also causes wear of the parts and hence reduces parts life and working efficiency.



**Figure 1: Visual comparison between Bangladeshi and Chinese cylinders**



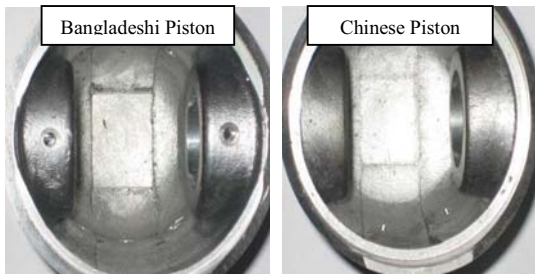
**Figure 2: Visual comparison between Bangladeshi and Chinese pistons**



**Figure 3: Visual comparison between Bangladeshi and Chinese piston crown**

Figure-3 shows the difference between the top part of the Bangladeshi and Chinese piston. This shows that casting of Bangladeshi one is not so good, but in other hand Chinese one shows better casting quality.

Piston crown forms bottom portion of the combustion chamber. Combustion quality mainly depends on the shape of the piston crown. There are some broken edges on the crown of the Bangladeshi one. These broken sections will cause breakage of flow pattern of the air fuel mixture during combustion and will reduce combustion efficiency as the hampered proper fuel atomization and vaporization. These defects also make hot spots which are cause of pre-ignition during combustion. Pre-ignition causes knocking in engine.



**Figure 4: Comparison between Bangladeshi and Chinese piston boss**

Figure-4 shows the bottom part of the Chinese and Bangladeshi piston. It is observed from the pictures that there are oil holes in Chinese piston which helps in lubrication system of engine, but in case of Bangladeshi one there are no such holes present. So lubrication system of Chinese one is better than the Bangladeshi one. It is one of the major defects of Bangladeshi piston.



**Figure-5: Microstructure of Chinese Cylinder Liner (x400)**



**Figure-6: Microstructure of Bangladeshi Cylinder Liner (x400)**

The figure-5 shows microstructure of Chinese cylinder which is pearlitic gray cast iron and the figure-6 shows microstructure of Bangladeshi cylinder which is ferritic gray cast iron. In the figures the white region contains ferrite and the blackish region contains pearlite.

In Bangladeshi one graphite flakes are large in size and in a ferrite matrix with small amount of pearlite. There are also some MnS inclusions and a few irregular islands of iron - iron phosphate eutectic micro-constituent. These features are seen in most cast irons.

In Chinese cylinder graphite flakes are small in size and in a pearlitic matrix with small amount of ferrite. There are also more MnS inclusions and irregular islands of iron - iron phosphide eutectic micro-constituent. The speckled white regions represent a phosphide eutectic. Cooling of the casting was rapid enough that the carbon rejected by the decomposing austenite could not reach the graphite flakes. Therefore, pearlite formed everywhere that the austenite was thereby retained. And the Pearlitic Gray cast iron has a better physical properties than the ferritic Gray cast iron. Pearlitic Gray cast iron has a tensile strength of 120 ksi where ferritic Gray cast iron has only 80 ksi.

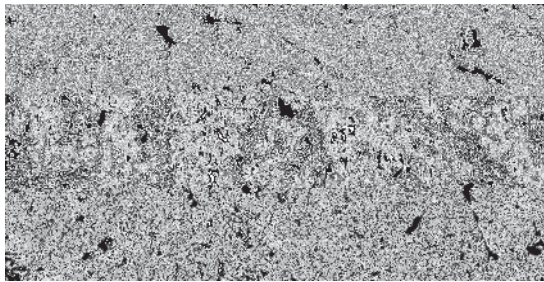
The main result of the Analysis of Chemical Composition are-

For reference cylinder liner

- a) Microstructure Shows ferritic Gray cast iron.
- b) White area contains ferrite.
- c) Graphite flakes are large in size and in a ferrite matrix with small amount of pearlitic.
- d) There are also some MnS inclusions and a few irregular islands of iron - iron phosphate eutectic micro-constituent. These features are seen in most cast irons.

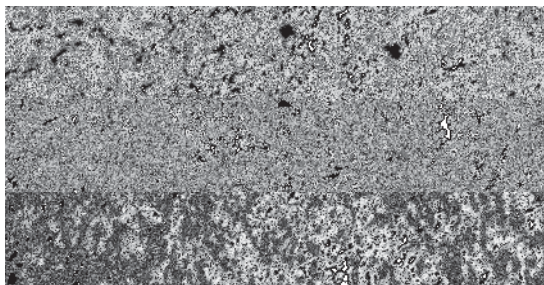
For reference cylinder liner

- e) Microstructure Shows pearlitic Gray cast iron.
- f) Graphite flakes are small in size and in a pearlitic matrix with small amount of ferrite.
- g) There are also more MnS inclusions and irregular islands of iron - iron phosphide eutectic micro-constituent.
- h) The speckled white regions represent a phosphide eutectic.



**Figure-7: Microstructure of Bangladeshi Piston (×400)**

The figure-7 shows microstructure of Bangladeshi piston which indicates Aluminium alloy. There are some needle visible in the stucture which actually indicates primary Aluminium. These primary Aluminium works as crack initiator and actually reduce the strength and life of Aluminium-alloy.

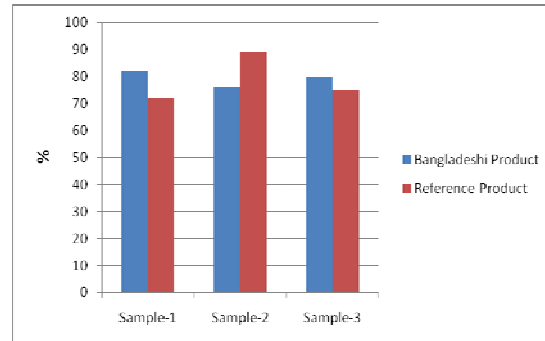


**Figure-8: Microstructure of Bangladeshi Piston (×400)**

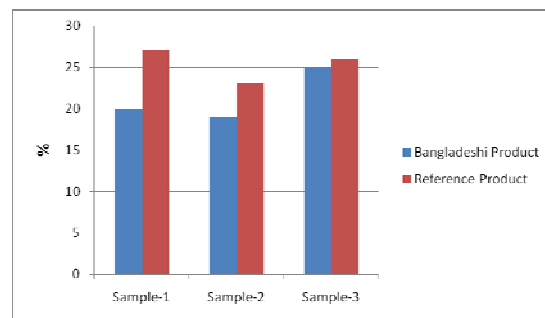
The figure-8 shows microstructure of chinese piston which also indicates Aluminium alloy, but there are no needle visible in the stucture. So this structure have a better strength.

The neddle in Banngladeshi piston can be broken by using modifier such as Stonetium, sodium & titenium which will ultimately improve the strength and life of Bangladeshi piston. In the chinese piston the manufacturer are actually used huge amount of stonetium to break the primary aluminium neddle. That’s why the Chinese piston has better strength and life.

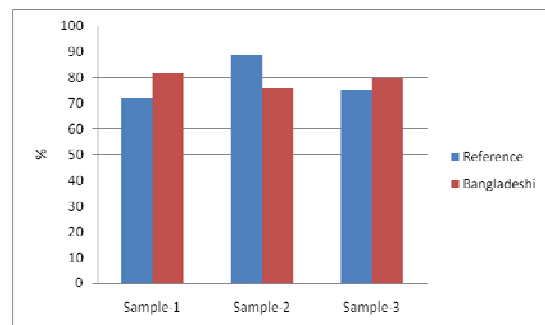
It is also observed that the hardness reference product is higher than Bangladeshi sample product. Figure 9 to 11 shows the variation hardness in-between reference and Bangladeshi product for three different samples.



**Figure-9: Brinell hardness number of reference and Bangladeshi piston.**



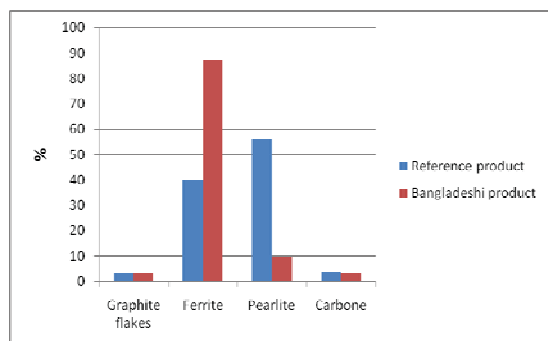
**Figure-10: Rockwell hardness number of reference and Bangladeshi Cylinder Liner.**



**Figure-11: Rockwell hardness number of reference and Bangladeshi pistons.**

It is observed that the hardness of reference and Bangladeshi product almost nearest, but the main difference found in their Chemical composition,

which shown in figure 12 and table 1 to 2. In Chemical composition TEST, 90.964% Almunium found in reference product, where in Bangladeshi product it gives valueless number. For this, reference product more malleable than Bangladeshi product.



**Figure-12: Composition of Reference and Bangladeshi Cylinder Liner.**

Specimen Chemical Composition	Bangladeshi Piston		Chinese Piston	
	01	02	01	02
Iron(Fe)	1.3182	1.1912	0.38817	0.38817
Silicon(Si)	2.5310	2.5504	5.7873	5.7873
Manganese(Mn)	0.16780	0.14069	0.08701	0.08701
Copper(Cu)	3.1767	3.0588	1.2277	1.2277
Nickel(Ni)	0.43770	0.45851	0.77813	0.77813
Chromium(Cr)	0.02512	0.02017	0.02304	0.02304
Titanium(Ti)	0.02592	0.02590	0.01705	0.01705
Tin(Sn)	0.07383	0.07079	0.03370	0.03370
Zinc(Zn)	0.25467	0.26772	0.00847	0.00847
Lead(Pb)	More	More	0.01214	0.01214
Magnesium(Mg)	0.04843	0.04843	0.67275	0.67275
Almunium (Al)	Less	Less	90.964	90.964

**Table 2: Comparative chemical composition of sample Bangladeshi and Chinese pistons**

Chemicals	% Composition	% Composition	% Composition
	LM25(Actual)	Bangladeshi	Chinese
Iron(Fe)	0.5 Max	1.3182	0.38817
Silicon(Si)	6.5 - 7.5	2.5310	5.7873
Manganese(Mn)	0.3 Max	0.16780	0.08701
Copper(Cu)	0.2 Max	3.1767	1.2277
Nickel(Ni)	0.1 Max	0.43770	0.77813
Chromium(Cr)	.03 Max	0.02512	0.02304
Titanium(Ti)	0.2 Max	0.02592	0.01705
Tin(Sn)	0.05 Max	0.07383	0.03370
Zinc(Zn)	0.1 Max	0.25467	0.00847
Lead(Pb)	0.1 Max	More	0.01214
Magnesium(Mg)	0.2 - 0.6	0.04843	0.67275

**Table 2: Comparative chemical composition of pistons**

## 5. RESULTS AND DISCUSSION

The present study aimed to prepare an acceptable quality of Bangladeshi product and compare the quality of Bangladeshi Piston and Cylinder Liner with a reference product, where sample product collected from selected famous shops in Bangladesh. Samples were judged by panel of experts by qualities and also were analyzed for chemical and mechanical properties. Significant difference was found in case of Bangladeshi and reference product interns of chemical and mechanical characteristics. Statistical analysis showed that Chemical composition and mechanical characteristics of Reference product were significantly higher than that of Bangladeshi sample product. The main drawbacks of Bangladeshi product are in terms of its alloy composition. By improving the alloy composition the performance of the local product can be brought to international standards. Higher technical institutes like BUET, MIST, IUT and others can play a vital role in improving the qualities of SME Products. In this regard SME Foundation may play a vital role in establishing an Institutional linkage with the industries and institutes. Government and many organizations have come forward for development of SME products. Now in almost every bank there is a separate section for SME loan. When educated persons with technical, practical, theoretical knowledge will come forward the SME sector will boom and the financial condition of Bangladesh may improve a lot.

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