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The Quality Development of the By-product from the Construction Sand Production Process for Substituting Raw Material in the Glass Industry, Case Study: Ban Lad Construction Sand Plant, Ayuthaya Province

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ABSTRACT
In 2012 Department of Primary Industries and Mines(DPIM) worked together with Siam City Concere Company (SCCO) to up grade the by-product from construction sand washing plant to silica sand grade in the glass industry by the minerial processing technology. SCCO produces the by-products sand about 200,000 ton per year. The by-products sand would be the land-filled sand which is the low price. On the other hand, the silica sand production to supply the glass and bottle industry is decline continously. Because of the problem in process of mining license and the permission of land owner.

The experiment study of the upgrading quality of the by-product from construction sand process in lab scale found that the significant factors are quantity/size of deposit, quality and chemical compositions of by-product.

The analysis of physical and chemical compositions of by-product shows this deposit having sand and impurities. There are pebble and coarse sand (size more than 30 mesh) approximately 10%, sand size smaller than 30 mesh about 70%, and fine dust (smaller than 65 mesh) 20% . The considering impurities are iron feldspar and mica. The design processing is composes of the screen impurities separation, the reduction of %Fe and by the scrubber and spiral concentrator. The experiment in lab scale found that the selected mineral process can upgrade the quality of by-product having size, quality and chemical compositions in standard specification of silica sand using in glass and bottle industries.

KEY WORDS: The by product sand/ Mineral processing/Ore dressing/the value added mineral

1. INTRODUCTION
Sand is the one of the important natural resources. Sand is common used and ingredient in many industries such as construction industry, Glass and bottle industry, Chemical industrial, Ceramic industry and etc. The usage of sand depends on size, quality and chemical composition. The applications of sand are Construction sand, general is a basic raw material in ready-mixed concrete production that a vital part of structure and building, this sand consisted with various size distribution that control by ASTM C-33. The market price (ex-bin price) of construction sand generally is 100-150 THB/Tons. (2) (2) Fill sand, this product usually is made from by-products that materials were overflowed from sand washing plant. The sand is high contaminated with organics and silt. The market price (ex-bin price) of fill sand generally is 40-80 THB/Tons. and (3) Silica sand or Glass sand, mostly common ingredient in glass. Whether the glass is container glass, window glass, silica sand makes up approximately 60-70 percent of glass batch and therefore has a significant affect on the glass quality. The market price (ex-bin price) is 400-700 THB/Tons regarding of this sand required high quality in quartz/silica content and with lowest organic content.

The original data of the department of primary industries and mines (DPIM) shows the silica sand production in Thailand to supply the domestic demand 1.5-2.0 million ton per year. As the silica sand reserve having mine potential decreases and the high trend of conservation of natural resources and environment, the extension of silica sand mining is difficult. If there is no the preparation of sustainable raw material in the future for industries, the industries using silica sand material may loss the competency.

As DPIM is the office for mineral resources administration and management for country maximum mineral resource usefulness and creates the sustainable raw material for the industrial demand, the department concerns
about the important guarantee of the sustainable raw material matching to the direction of the country industrial development. Since natural silica sand is a low reliable in supply, lower in chemical content (silica) in natural silica sand and furthermore, the environment and social constraint are strongly increase that resulting to high restrict and barriers for new players that bring to scarcity in natural silica sand. For this mission the department studies and preliminary evaluates the quality development of by-product from construction sand process for substitution raw material in glass industries. This by-product is mainly used for land filled material. The preliminary study result shows that there is possibility to develop by-product from construction sand process for substitution silica sand in glass industries by mineral process technique.

This study aims to find the process in laboratory scale to development quality of by-product from construction sand process for substitution silica sand in glass industries.

Therefore, Siam City Concrete Company (SCCO) cooperates with DPIM have initiated idea for development fill sand to silica sand.

2. BAN LAD CONSTRUCTION SAND PLANT, AYUTHAYA PROVINCE

Ban lad constructions sand plant located in Ayuthaya province 80 Kms, ahead north from Bangkok. It is fully controlled by SCCO, which is one of the leading construction companies in Thailand. The by-products sand is produced approximately 15,000 tpm. From latest estimated, sand reserve at Ban lad plant is secured sand & gravel volume much more than 20 million ton. With this volume is portioned to by-product sand about 10% that mean is have reserve for fill sand reach to 2 million tons.

3. THE EXPERIMENTAL STUDY OF THE UPGRAADING QUALITY OF BY-PRODUCT FROM CONSTRUCTION SAND PLANT

The experiment study of the upgrading quality of by-product from construction sand process in lab scale was done at Mineral Processing Group’s pilot plant, Papadeang District, Samut Prakan Province. The analysis of physical testing of the by-product sand shows that the size more than 35 mesh is approximately 40%, less than 35 mesh 57%, and fine dust (less than 100 mesh) 3%. The chemical composition found that SiO₂ is 90%, Fe₂O₃ 1.67%, Al₂O₃ is 5.7% and others is 2.63%.

The purpose of this study is to upgrade the quality of by-product to meet the requirement of glass industry. The main requirements of glass industry are focused in the particle size which is less than 50 mesh and the chemical quality which is SiO₂ must more than 98.5%, Fe₂O₃ less than 0.03% Al₂O₃ less than 0.1%.

Therefore, the designed process will be defined in 3 stages as shown in below figure: the deslime, the reduction of Al₂O₃ and Fe₂O₃. The flow chart is showed in figure 1.

![Fig. 1 The experiment flow chart](image)

4. RESULT

By-product is washed with water (deslime) to eliminate fine dust and mud. The coarser part is sized with 35 mesh (420 micron) screen. The oversize is pebble and coarse sand about 15% by weight.

The undersize passing 35 mesh screen is mixed with water in mixer tank and pumped to the scrubber to reduce the aluminum oxide coating on the particle. In this experiment, the flotation cell is applied instead scrubber. The optimum % solid in the scrubber tank is 40-50%.

The reduction of Fe₂O₃ will be done by the shaking table that is applied instead spiral concentrator. This technique uses the different of specific gravity principle to separate heavy mineral from light mineral. The heavy mineral is in concentrate which are
impurities having higher specific gravity than sand. The light mineral is in middling which is the by-product for substitution silica sand. The tailing part mainly is fine sand mixing with water. The suitable conditions are pulp flow rate 30-40 kilogram per minute, 20-40 % solid. % yield of the upgraded by-product by shaking table is approximately 80 %.

Tab.1 The chemical composition of raw material and product

<table>
<thead>
<tr>
<th>Sample</th>
<th>Chemical Composition (%) weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fe₂O₃</td>
</tr>
<tr>
<td>Raw Material</td>
<td>1.670</td>
</tr>
<tr>
<td>Product</td>
<td>0.019</td>
</tr>
<tr>
<td>Standard Sand in Glass Industry</td>
<td>0.03</td>
</tr>
</tbody>
</table>

5. DISCUSSION AND CONCLUSION

5.1 Study Result Conclusion
By-product from construction sand process mainly used as land filled or waste sand can upgrade the quality by mineral processing technology for substitution natural silica sand in glass industries. The experimental results show that the by-product sand can be upgrade and used as substitution silica sand in glass production process.

5.2 Suggestion
It should expand the experiment to the pilot scale and promote the glass producer to use the upgrades by product sand instead of the silica sand.

It should have experimental study of the upgrading quality of the by-product sand from construction sand process at the other potential deposits because each deposit may have different physical and chemical compositions.

It should have the experimental study of taking the upgraded quality by-product for substitution silica sand in the other industries using silica sand as raw material such as chemical industry and ceramic industry. This is to support the usage of the upgraded quality by-product for substitution silica sand in industries using silica sand as raw material.

REFERENCES