GETAHINDUS (M) SDN BHD

THE FEDERATION OF THE RUBBER TRADE ASSOCIATIONS OF MALAYSIA (FRTAM)

Malaysia Rubber Producer Association (MRPA)

MRC INDUSTRY LINKAGE FUND INDUSTRY-UNIVERSITY INTERACTION SESSION 2021

- Presented by Mr. Tan Swee Hua

TOPICS TO DISCUSS

1) **Automation and Mechanisation of Centrifuge Machine Operation and Cleaning Process.**
2) **Identification of Protein Type in Natural Rubber Latex that affect Curing Process, Aging and Physical Properties of Final Dipped Articles.**
3) **Correlation of Carboxylate Group Contents in NBR Latex and Its Potential Impact on The Physical Property of Metallic Crosslinked Product.**
4) **Production of Ultra-Low or Zero Protein Artificial Natural Rubber Latex from Natural Rubber for Dipping Process.**

1. Automation and Mechanisation of Centrifuge Machine Operation and Cleaning Process

Introduction

- Natural rubber is commercially harvested by tapping, cutting a thin layer of bark, enabling the latex to flow into a cup. The Field Latex (FL) has a dry rubber content (DRC) of about 25-40%. It also contains some Magnesium ions, natural rubber protein and impurities accumulated during the harvesting process.

- This FL is bulked, preserved and delivered to latex factory which will be treated with diammonium phosphate to chelate the free magnesium present. The FL is generally left overnight for the sludge to settle. The latex is then fed into centrifuge machine as shown in the pictures below.

Rubber Tapping & Grades

Field Latex

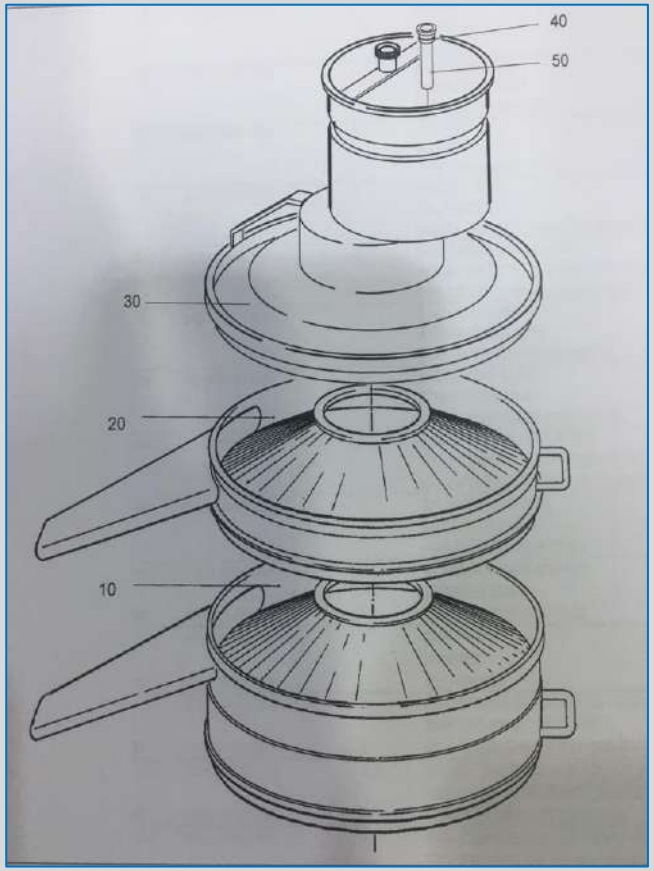
Rubber Cup Lump

- **RSS**
- **ADS**
- **SMR L**
- **SMR CV**
- **Latex Concentrate**

- **SMR 10**
- **SMR 20**
- **House Grade**

} **TSR**

Centrifuge Machine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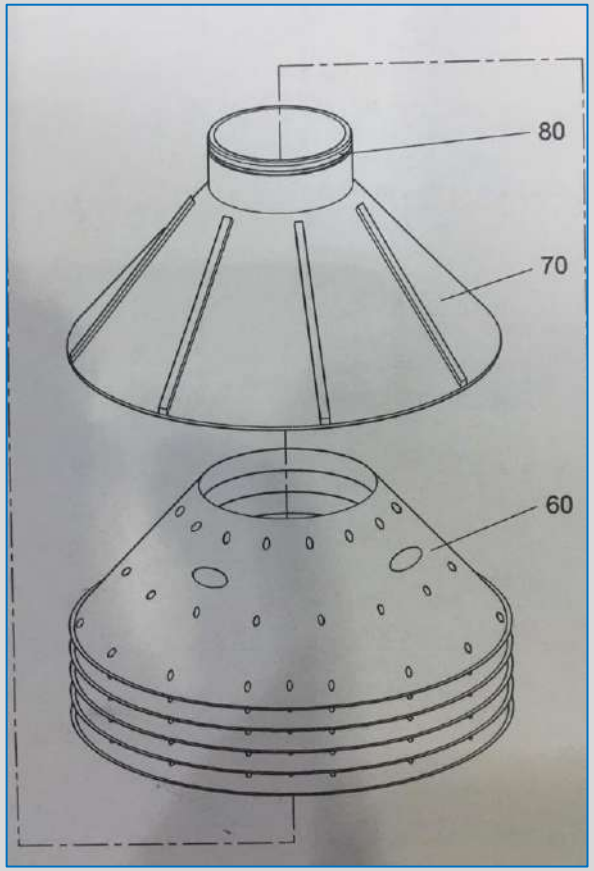
80
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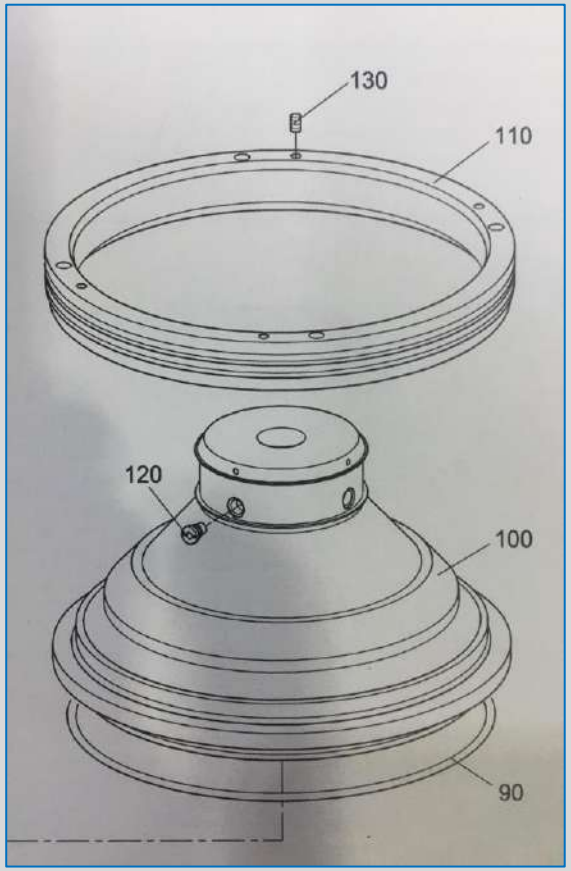
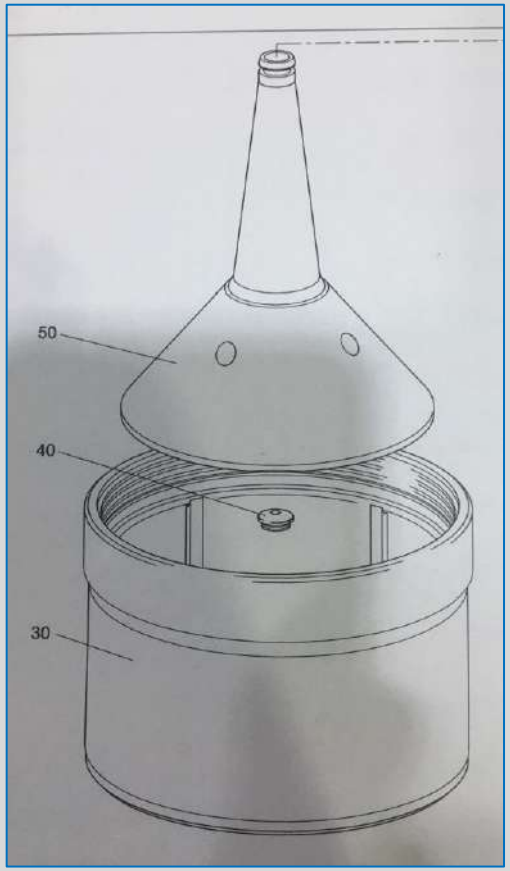
60


130
110
120
100
90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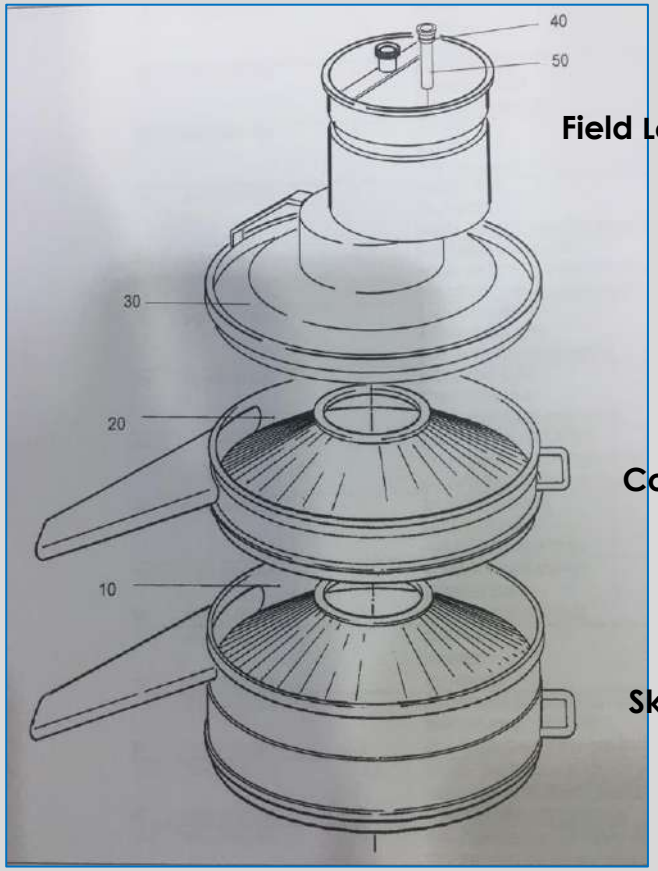
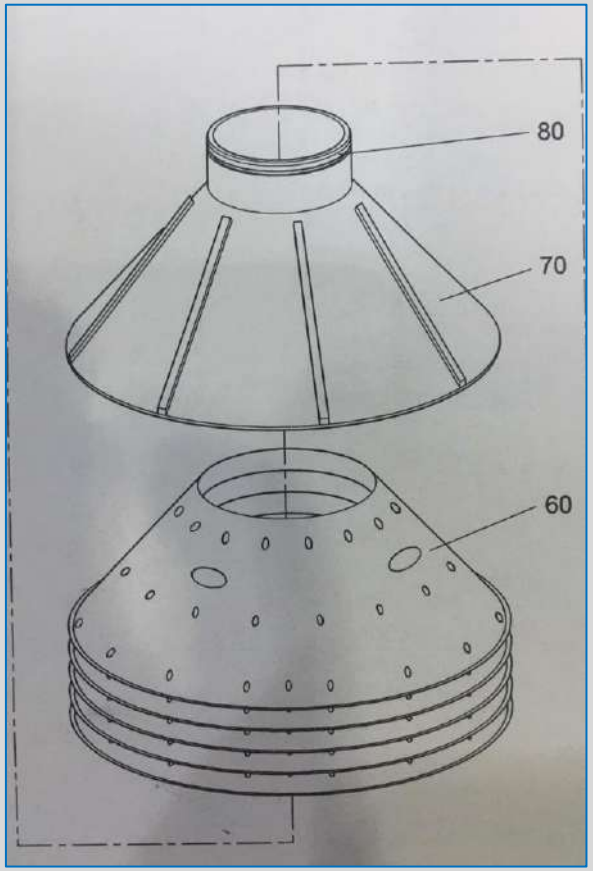
Below are the details of all the individual parts of the LTC200 centrifuge machine:



Field Latex Chamber - 10.50 kg

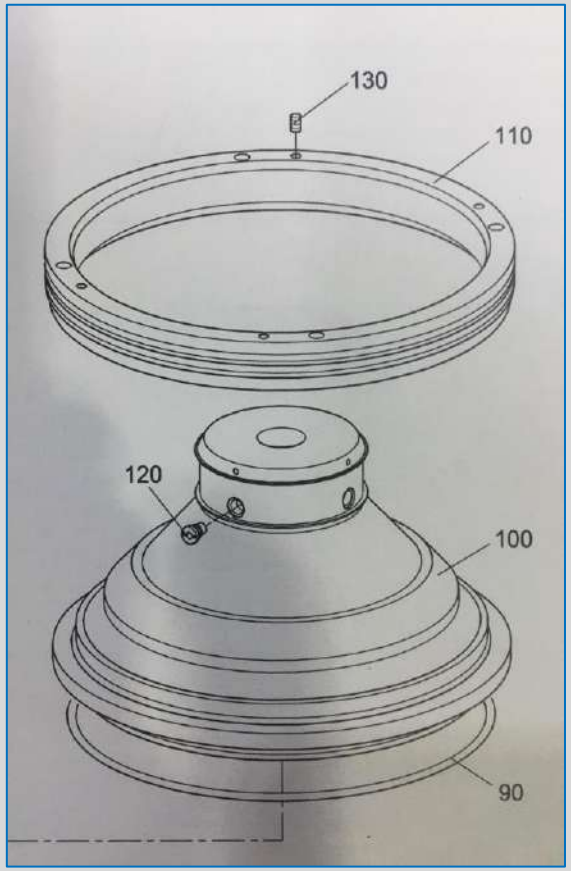
Concentrate Cover - 8.65 kg

Skim Cover - 15.80 kg



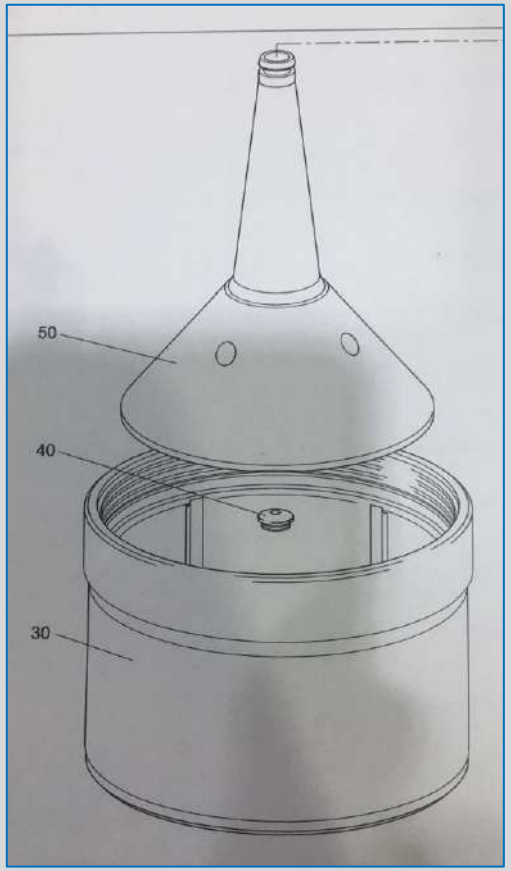
Top Separating Disc - 8.65 kg

Bowl Disc (per piece) - 0.77 kg,
(Total approx. 190 pcs =146.3 kg)



Lock Ring - 15.95 kg

Bowl Top - 86.4 kg



Distributor - 25.50 kg

Bowl Bottom - 164.20 kg

Objective

- Currently, the centrifuge operation is mainly human operated which is not difficult but deem to be dirty, wet and tiring laborious job.

- The difficult part is this centrifuge machine must be cleaned at regular interval, every 3-4 hours as there will be sludge, mainly soil or magnesium phosphate and coagulated rubber lumps accumulated inside the bowl.

- We are looking at how these various dismantling and cleaning steps can be mechanised or automated.

- This will make the work lighter, easier and cleaner to enable industry to attract local workers to undertake this task.

2. Identification of Protein Type in Natural Rubber Latex That Affect Curing Process, Aging and Physical Properties of Final Dipped Articles

Introduction

- Protein is one of the major components of non-rubber content in field latex (approximate 1.5 - 4 W%) which participate in the latex curing process; thereby affecting the properties of final dipped products. There are many types of protein in natural rubber latex (NRL). The aim of the research is to identify the type of protein species on NRL that affect the curing behaviour of compounded latex and its effect on the aging resistance and physical properties (PP) of final dipped product.

Aim

- To identify the protein species/ group of proteins that can affect the curing behaviour, PP and aging resistance of final product.
- To synthesize the protein species identify above for commercial applications for the purposes of enhancing the cure rate and physical properties of the dipped products.

Relevant Literature Study / Reference:

- Based on literature study and industrial experience, a purified Latex like low protein latex or double centrifuge latex, generally cure slower than a normal Latex Concentrate Using the same curing system with known dose of sulphur, accelerator and Zinc Oxide.
- The difference between the above two lattices is that the purified latex has lower non rubber and thus lower natural rubber protein.

Challenges/ Limitations

- Disposable examination gloves is the biggest gloves volume used in the world. This gloves are either made from NRL or NBR Latex. In fact the current market share has dropped from 100% NRL in the 1980s to 35% NRL currently.
- The main reason being NRL contain natural proteins, some of which can cause unwanted allergic reaction to some healthcare workers, especially those who have developed sensitivity toward NRL protein.
- Thus it is desirous to remove or reduce these Natural Protein from NRL. However, as stated earlier, the curing rate and ageing, PP are affected.

Challenges/ Limitations

- As a common industrial practice, centrifugation and enzyme digestion are used to remove/reduce the protein in NRL. Water extractable protein contents in NRL is known to be the major cause in Type I latex protein hypersensitivity or allergenic reactions to skin contact. The resulted NRL with reduced protein contents, is slower cure and with poor mechanical properties. This implies that protein participates in the crosslinking process. In our opinion, understanding and identifying the protein species that play a role in latex curing can be an useful information. From there, creating an artificial protein which can help the curing process yet does not exhibit allergenic properties in the final dipped products is of great importance.

Reference:

Smitthipong, W., et. al. (2014). Effect of non-rubber components on properties of sulphur crosslinked natural rubbers. In Advanced Materials Research (Vol. 844, pp. 345-348). Trans Tech Publications Ltd.

3. Correlation of Carboxylate Group Contents in NBR Latex and Its Potential Impact on The Physical Property of Metallic Crosslinked Product

Introduction

- Raw carboxylated NBR (XNBR) is a terpolymer of butadiene, acrylonitrile and acrylic acid. The presence of the carboxyl group can facilitate the ionic crosslinking process to occur when contacted with metal oxide such as zinc oxide. Such crosslinking process is commonly used in the commercial compounding of NBR latex.
- Therefore, these carboxylate groups have certain degree of impacts onto the latex's curing behaviour, polarity, mechanical and thermal properties, eventually, affecting physical properties of the final products. Currently concentration of the carboxylate group is not a standard publish data.
- More critically, the correlation of carboxylate group and the metal crosslinking of NBR latex has not been well-studied with respects to their curing behaviours.

Aim

- To establish a simpler method to determine the amount of carboxylate group content in NBR latex.
- To determine the potential impacts of carboxylate group content on the physical property of final product when metallic cross-linker is used.

Challenges / Limitations:

- Currently, there is no simple method developed for carboxylate content for the industries.
- The correlation of carboxylate group on the NBR curing is also yet to be fully understood.
- Understanding the curing mechanism of metallic cross linker with the carboxyl group will enable industries to further improve their process and products.

Reference

Ai, C., Gong, G., Zhao, X., & Liu, P. (2017). Determination of carboxyl content in carboxylated nitrile butadiene rubber (XNBR) after degradation via olefin cross metathesis. Polymer Testing, 60, 250–252. https://doi.org/10.1016/j.polymertesting.2017.04.004

4. Production of Ultra-Low or Zero Protein Artificial Natural Rubber Latex from Natural Rubber for Dipping Process

Introduction

- Numerous researches have been attempted to reduce/ remove the protein contents from field latex, such as enzymatic, mechanical and chemical treatments. However, the results were not promising in removing protein contents. In most cases, removing the natural protein affect the latex's colloidal properties and its processability.
- In this project, it is proposed that instead of FL, dry natural rubbers with protein removed will be used as a starting material.
- The first part of this project will involve producing protein free natural rubber.
- The second part is to solubilize the rubber using suitable solvent and emulsified using suitable system.
- This project is deemed commercially attractive in view of current price of synthetic polyisoprene latex.

Aim

- To remove the protein contents from dry rubber using suitable techniques.
- To dissolve and emulsify the protein-free rubber into artificial natural rubber latex.

Challenges/ Limitations

- The current challenge is to identify the suitable methods to remove natural occurring protein and nitrogenous compound till zero total nitrogen content in dry natural rubber. Next is emulsify the zero-protein dry rubber into latex form suitable for dipped articles applications.

Reference

Tanaka et al. (2020). Retrieved 7 September 2020, from https://patentimages.storage.googleapis.com/d0/ee/d9/8b5f4c6c95aafb/US5622998.pdf

End of the presentation
Thank you!!!

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- Getahindus is a 33 years old company and the leading latex compounder and formulator in the world. Getahindus also supply many specialities latex for various unique application.
- If any researcher choose Getahindus as a collaborator, we will be able to provide more in-depth information, and provide samples and application evaluation