Finally, N-deacetylation (from Chitin to Chitosan). The chitin (10 g) was put into 100ml of50% NaOH at 60°C for 8 hours to prepare crude Chitosan. After filtration, the residue was washed with hot distilled water at 60°C for three times. The crude Chitosan was obtained by drying in an air oven at 50°C for 2 hours. Pure chitin sample of 40g were refluxed in 100ml 50% NaOH solution at 130^{o}C for 2hours. The product were filtered and washed repeatedly with distilled water and dried at 50^{o}C for 2 hours (Murat *et al*., 2015).

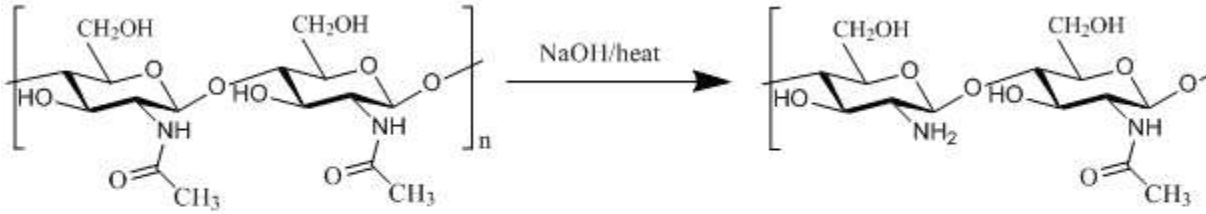

Figure:1 Schematic reaction of Chitin to Chitosan

pH: the pH measurement of the chitosan solutions was carried out using a PHS-3 pH meter.20ml solution was added to 10g of grasshopper weighed into a 50ml beaker. The suspension was allowed to stand for 30 minutes with occasional stirring. The suspension was again allowed to stand for another 30 minutes undisturbed to allow the fine particles to settle. The supernatant liquid was decanted into a clean 50ml beaker and the pH was determined using an electrical PHS-3D pH meter.

Solubility: chitosan is usually tested in acetic acid by dissolving it in 1% or 0.1M acetic acid. It demonstrated that the amount of acid needed depends on the quantity of chitosan to be dissolved. The solubility of chitosan was demonstrated in various solutions like distilled water, acetone, ethanol, acetic acid and petroleum ether.

The degree of acetylation and deacetylation of chitosan: determined using an infrared ray spectroscopy, applying the formula as stated by (Murat *et al*., 2015)

$$DDA=\frac{\boldsymbol{A64.084}}{\boldsymbol{A97.862}}\times 100 \qquad \text{equation. 1}$$

Moisture Content is based on drying a sample in an oven and determining moisture content by the weight difference between dry and wet material. 2 g of previously ground sample was weighed out and placed in drying oven at 105°C for at least 3 hours after which the sample was allowed to cool in a dryer. The sample was weighed again, taking care not to expose the sample to the atmosphere. The following calculation was made afterwards (Shanta *et al*., 2015)

$$\text{Moisture content (\%)} =\frac{(\boldsymbol{B-A})-(\boldsymbol{C-A})}{\boldsymbol{B-A}}\times 100 \qquad \text{equation .2}$$

Where:

A = Weight of clean, dry scale pan (g)
B = Weight of scale pan + wet sample (g)
C = Weight of scale pan + dry sample (g)

Ash Content 2 g of the dried powdered sample was weighed (W_1) into pre-weighed empty crucible (W_0) and placed into a muffle furnace at 550^{o}C for 5 hours. The ash was cooled in a desiccator and weighed (W_2). The weight of the ash will then be

determined by the difference between the powdered dried sample, pre-weighed and the ash in the crucible. Percentage ash was obtained by the following equation

Ash content (%) = $\frac{W2-W0}{W1-W0}$ X100 equation.3

Where:
W_2 = Weight of empty crucible (g)
W_0 = Weight of crucible + powdered sample (g)
W_1 = Weight of crucible + ash sample (g)
Agricultural Application of Chitosan Beans seed has been planted at three different portions, in which two have been combined with chitosan and the other one without chitosan to observe the effect of nematodes against the plant.

Result

Table: 1 pH values for Chitin and Chitosan

S/N	Chitin	Chitosan
1	**7.25**	**7.00**
2	**7.25**	**7.25**
3	**7.28**	**7.00**
Average	**7.26**	**7.08**

Table 2: Chitosan Moisture and Ash Content Value

S/n	Chitosan	Result
1	Moisture Content	19%
2	Ash Content	20%
3	% chitosan yield	64%

Table 3: solubility values of chitosan

S/N	Reagent	Observation
1	Acetic acid	Insoluble
2	Ethanol	Insoluble
3	Petroleum ether	Insoluble
4	Water	Insoluble
5	Acetone	Insoluble

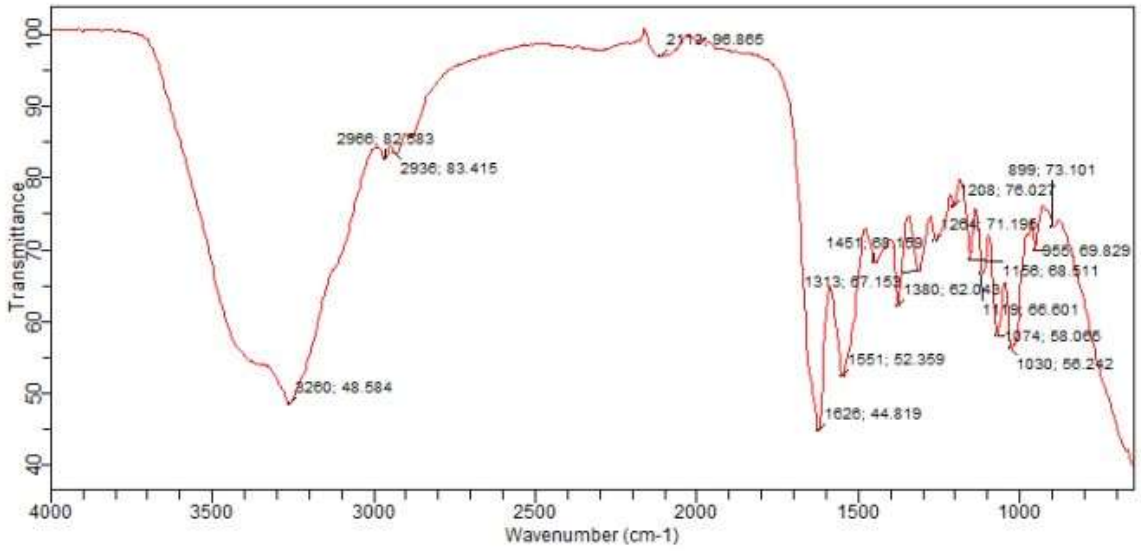

Figure 2: FT-IR of Chitin

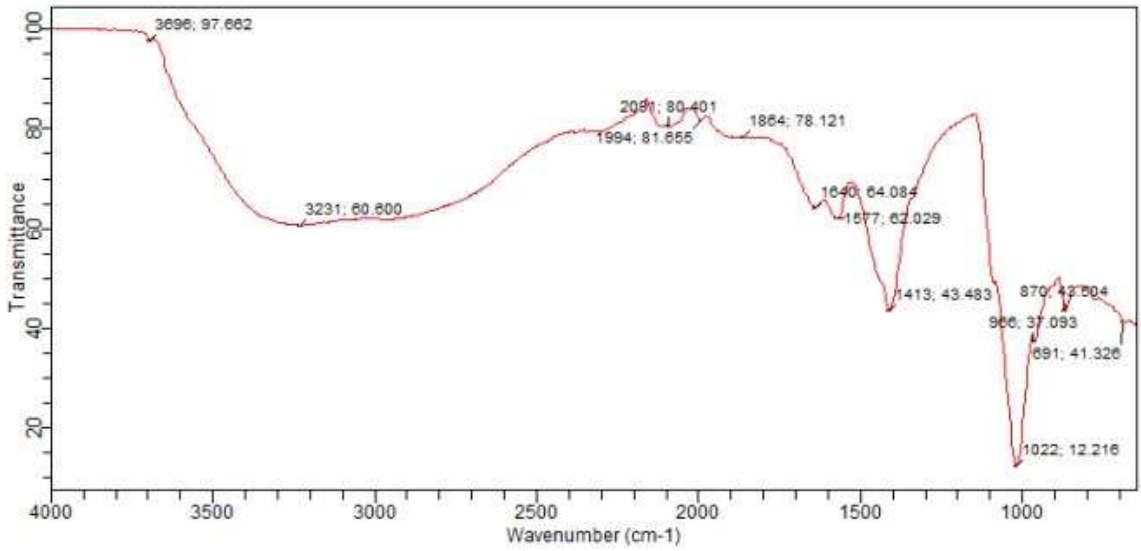

Figure 3: FT-IR of Chitison

Discussion of Result

Analysis of pH: from the result obtain above, the pH values for the chitin range between 7.26-7.08 which show that the chitin is neutral while for the chitosan it ranges from 7.00-7.06 is also neutral. Which indicate complete demineralization of chitin and deacetylation of chitosan.

Moisture Content: the moisture content of chitosan is 19% which is obtained from the analysis, which show that the moisture in the chitin is very low.

Ash Content: ash content is one of important parameters that determine the quality of chitosan. The lower the ash content then the higher chitosan quality. The ash content of grasshopper chitosan was determined to be 20% which indicate that the chitosan is of higher quality.

Solubility: the chitosan was dissolved in different solvents such as acetone, ethanol, petroleum ether, water and acetic acid. It shows insoluble in all the solvent, which indicate that chitosan deacetylation is 64%1, because the removal of acetyl group is not completed by demineralization process. When the degree of deacetylation is greater than 90%, the biopolymer becomes soluble in acidic aqueous solutions and behaves as a cationic polyelectrolyte due to the protonation of amine groups in the presence of H^+ ion.

FTIR Analysis: from interpretation of FTIR, it can be said that all the functional groups which are added during synthesis have been identified in the of peaks. This indicates the successive formation of chitin biopolymer. During acid hydrolysis of chitin desired temperature is maintained to remove minerals such as calcium carbonate and proteins. It can also be interfered that as shell powder to acid ratio increases, yield and product appearance also increase. The grasshopper chitin shows an intensive peak at 1000-1350cm^{-1} which correspond to the N-H deformation of amide 1, the band at 1313. cm^{-1} are attributed to vibration of amide in band 1, at 1690 -1640 cm^{-1} attributed to C=O group by H bond . The sharp peak at 1551.52 cm^{-1} corresponds to asymmetric deformation of CH_3 group but at 1040 -1250 cm^{-1} correspond to a peak of -O- . The FITR result of chitosan, the spectra correspond to the deacetylated sample with NaOH for 2hrs, which show a spectrum of broad band of N-H from 3500-3300 cm^{-1} which indicated the presence of primary amine. The band at 1577 cm^{-1} has a large intensity than 1640 cm^{-1} when deacetylation occur, which indicate that the band observed at 1640 cm^{-1} decrease while the growth at 1577 cm^{-1} occur indicate the presence of NH_2.

Agricultural Application of Chitosan: the beans seeds mixed and planted with chitin, chitosan and without both were attacked and destroyed by the nematodes this shows at 64% chitosan conversion has no effect against nematode infection.

Summary and Conclusion

The chitosan obtained and prepared using demineralization, deprotonation, decolorization followed by deacetylation. Its pH, solubility, moisture, ash and FTIR spectra was carried out and obtained. The percentage conversion yield shoes no effect against nematode. The result for the chemical reaction as it offers a clean, cheap, and convenient method for extracting chitosan from chitin extracted from grasshopper. Within the results in this work, the conclusion was reached that grasshopper are an excellent source for chitin. The yields and acetylation degree of chitosan increase with increasing the concentration of NaOH solution, the temperature, and the length of treatment. The chitosan obtained showed the highest degree of deacetylation.

REFERNCE

Ashford. D. (1992) :Carbohydrate analysis,A Review. Curr. Opin. Biotechnol 3: 45- 48.

Dario R. O., Luis F. Z. G., & Guadalupe G.S. (2017): Current Applications of Chitosan and Chito-Oligosaccharides. A *Review, Journal of Drug Design and Research*, 2: 1-6.

Gustavo A. M. R.,& Hector F. Z. C.(2017) :Chitosan, Chitosan Derivatives and their Biomedical Application, A review, Biological Activities and Application of Marine Polysaccharides, 3: 88-100.

Judsonh.s.(2013): Synthesis and Characterization of Chitosan from shrimp shells, *unpublished thesis, university Tunku Abdllrahman.*

Jose, C. V. J., Daylin R. R., Carlos A. A. S., & Galba M. C. (2016): Physicochemical and antibacterial Properties of Chitosan Extracted from Waste Shrimp Shells, *A review, International Journal of Microbiology:* 1-7http://dx.doi.org/10.1155/2016/5127515.

Manoj K P., DebasritaD.(2013): Chitosan: A Versatile Biopolymer For Various Medical Applications *A Review, International Journal Of Scientific & Engineering Research 4:1-16.*

Mincea M., Negrulescu A., &Ostafe V. (2012): Preparation, Modification, And Applications Of Chitin Nanowhiskers*: A review, Rev. Adv. Mater. Sci. 30: 225-242.*

Shanta P., Paras N. Y., & Rameshwar A. (2015): Applications of Chitin and Chitosan in Industry and Medical Science, *A Review, Nepal Journal of Science and Technology 16:99-104.*

Stephen O. M. (2016):Current Development of Extraction, Characterization and Evaluation of Properties of Chitosan and Its Use in Medicine and Pharmaceutical Industry, *A Rieview, American Journal of Polymer Science ,**6 : 86-91.***

Sneha p., Aiswarya J., Changam S. S.,& Sanjay M. C. (2014) :Extraction and Purification of Chitosan from Chitin Isolated from Sea Prawn (Fenneropenaeus Indicus*), A review, Asian Journal of Pharmaceutical and Clinical Research 4: 201-203.*

Thillai N. S, Kalyanasundaram N. (2017): Extraction and Characterization of Chitin and Chitosan from Achatinodes *.A Review, Natural Products Chemistry &Research 5:15.*

Yong Zhao, R. & Riccardo A.A. M.(2010): Chitin Deacetylases: Properties and Applications. *A review, Marine Drugs 8: 24-46*

Rinaudo, M. (2006): Chitin and chitosan: Properties and applications, *A review, Science Direct 31:603-632.*

Zouhour L., Salah S., Saloua S., & Amor A. (2011): Extraction and characterization of chitin and chitosan from crustacean by-products: Biological and physicochemical properties, *A review, African Journal of Biotechnology 10 (4): 640-647*.DOI: 10.5897/AJB10.209.