REFERENCES

1. Abdollahi, M., Rahmatpour, A., Aalaie, J., Khanbabae, G., (2008). Preparation and evaluation of the microstructure and properties of natural rubber/ sodium montmorillonite nanocomposites, *Iranian Polymer Journal*, 17(7), pp. 519-529.

2. Adams, J.M., (1987). Synthetic organic chemistry using pillered cation exchange and acid treated montmorillonite ctalysts- a review. *Applied Clay Science, 2*(4), pp. 309-342.

3. AGM, Sri Lanka association of manufactors and exports of rubber product, Cinamon Grand Colombo, 21 January 2019, Avalable at http:/Slamerp.lk/news/SriLanka

4. Alex, R., Nah, C., (2006). Preparation and characterization of organoclay-rubber nanocomposites via a new route with skim natural rubber latex, *Journal of Apllied Polymer Science, 102*(4). pp. 3277-3285.

5. Alexandre, M., Dubois, P., (2000). Polymer-layered nanocomposites: preparation, properties and uses of a new class of materials, *Materials Science and Engineering, 28*(1-2), PP 1-63.

6. Alkadsi, N.A.N, (2008). Comparative studies on the effect of titanate coupling agent on the mechanical properties of zinc oxide- filled chlorprene and natural rubber, *International Polymer Science and Tecnology, 35*(7), pp. 226-230.

7. Alwis, G.M.C., Ratnayaka, U.N., Kottegoda, N., (2013). Reinforcement and curing characteristics of organoclay filled natural rubber nanocomposites, *Journal of Rubber Research Institute of Sri Lanka,* 93, pp. 89-103.

8. Amarasiri, A., Ratnayake, U.N., Silva, U.K., Walpalage, S., Siriwardena, S., (2013)., Natural rubber latex-clay nanocomposites: use of montmorillonite clay as an alternative for conventional $CaCO_3$, *Journal of the National Science Foundation of Sri Lanka, 41*(4), pp. 293-302.

9. Ames, K., Gibala, D., and Hamed, G.R., (1996). Styrene-Butadiene Rubber filled with fluorinated Carbon Black: part II. Effect of curative level. *Rubber Chemistry and technology, 69*(2), pp. 273-276.

10. Amnuaypornsri, S., Sakadapipanich, J., Toki, S., Hsiao, B.S., Ichikawa, N., Tanaka, Y., (2008). Strain-induced crystallization of natural rubber: effect of proteins and phospholipids, *Rubber Chemistry and Technology, 81*(5), pp. 753-766.

11. Aranda, P., Ruiz-Hitzky, E., (1992). Poly(ethylene oxide)- silicate intercalation materials, *Chemistry of Materials*, *4*(6), pp. 1395-1403.

12. Arrighi, V., McEwen, I.J., Qian, H., Prieto, M.B.S., (2003). The glass transition and interfacial layer in styrene-butadiene rubber containing silica nanofiller, *Polymer*, *44*(20), pp. 6259-6266.

13. Arroyo, M., Lopez-manchado, M.A., Herrero, B., (2003). Organo-montmorillonite as subtitute of carbon black in natural rubber compounds, *Polymer, 44*(8), pp. 2247-2453.

14. Ashraf, S.M., Ahmad, S., Riaz, U., (2009). *A laboratotory manual of polymers*, PP. 35. L.K Publishing house pvt(Ltd). New Delhi

15. Avalos, F., Ortiz, J.C, Zitzumbo, R., Lopez-Manchado M.A., Verdejo, R., Arroyo, M., (2008). Effect of montmorillonite intercalant structure on the cure parameters of natural rubber, *Europhian Polymer Journal, 44*(10), pp. 3108-3115.

16. Bala, P., Samantaray, B.K., Srivastavas, K., Nando, G.B., (2004). Organomodified montmorillonite as filler in natural and synthetic rubber, *Applied Polymer Sience, 92*(6), pp. 3583-3592.

17. BaO, Y., LiGong, T.J (2010). *Testing and evaluation of inorganic materials*, Trans Tec Publications Ltd, Switzerland.

18. Beall, G.W., Goss, M., (2009). Self assembly of organic molecules on montmorillonite. *Applied Clay Science*, *27*(3), pp. 179-186.

19. Belton, D.B., Deschaume, O., Perry, C.C., (2012). An overview of the fundermentals of the chemistry of silica with relavance to biosilicification and tecnological avances, *FEBS Journal*, *279*, pp. 1710-1720.

20. Bharadwaj, R.K., Mehrabi, A.R., Hamilton, C., Trujillo, C., Murga, M., Fun, R., Chavira, A., Thompson, A.K., (2002). Structure-property relationships in cross-linked polyester-clay nanocomposites, *Polymer*, *43*(13), pp 3699-3705.

21. Bharadwaj, P., Singh, P., Panday, K.N, Verma, V., Srivastava S.K., (2013). Structure and properties of styrene buitadiene rubber/ modified hectorite clay nanocomposite, Applied Polymer Composites, *1*(4), pp. 207-224.

22. Bhattacharya, M., Maiti, M., Bhowmick, A.K., (2008). Influence of different nanofillers and their dispersion methods on the properties of natural rubber nanocomposites, *Rubber Chemistry and Technology*, *81*(5), pp. 782-808.

23. Bhowmick, A.K., Bhattacharya, M., Mitra, S., (2010). Exfoliation of nanolayer assemblies for improved natural rubber properties: methods and theory, *Journal of Elastomers and Plastics*, *42*(6), pp. 517-537.

24. Biswas, M., Ray, S.S., (2000). Water –dispersible nanoomposites of poly aniline and montmorillonite, *Journal of Applied Polymer Science*, *77*(13), pp. 2948-2956.

25. Blacklley D.C. (1997a). Types of lattices, *Polymer lattices science and Technology*, Volume 2, 2nd edition, pp.72-97. Chapmann & Hall, London, UK.

26. Blacklley D.C. (1997b). Applications of latices, *Polymer lattices science and Technology*, Volume 3, 2nd edition, pp.271-272. Chapmann & Hall, London, UK.

27. Blacklley D.C. (1997c). Fundamental principles, *Polymer lattices science and Technology*, Volume 1, 2nd edition, pp.351-355. Chapmann & Hall, London, UK.

28. Blow, C.M (ed)., (1971). *Rubber Technology and Manufacture*, Buttenvorths, London, P 227.

29. Blow S (ed)., (1998). *Handbook of Rubber technology*, Galcotia Publication Ltd, New Delhi, p 483.

30. Bottcher, H., Hallensleban, M.L, Wurm, H., Bauer, J., Behrens, P., (2002). Organic/ inorganic hybrids by living/ controlled ATRP grafting from layered silicates, *Journal of Material Chemistry*, *12*(5), pp. 1351-1354.

31. Brown, P.S., Tinker, A.J., (1990). Crosslink distribution in vulcanized blends of NR and EPDM, *J.nat.Rubb.Res.*, *5*(3), pp. 157-162.

32. Burnside, S.D., Giannelis, E.P., (2000). Nanostructure and properties of poly siloxane-layered silicate nanocomposites, *Journal of Polymer Science Part B Polymer Physics*, *38*(12), pp. 1595-1604.

33. Camargo, P.H.C., Satyanarayana, K.G., Wypych, F., (2009). Nanocomposites: synthesis, properties and new application opportunities, *Material Research*, *12*(1), pp. 1-39.

34. Carli, L.N., Roncato, C.R., Zanchet, A., Mauler, R.S., Giovanela, M., Brandalise, R.N., Crespo, J.S., (2011). Characterization of natural rubber nanocomposites filled with organoclay as a substitute for silica obtained by the conventional two-roll mill method, *Applied Clay Science*, *52*(1-2), pp. 56-61.

35. Carretero-Gonzalez, J., Valentin, J.L., Arroyo, M., Saalawachter, K., Lopez-Manchado, M.A., (2008). Natural rubber/clay nanocomposites: Influence of poly(ethylene glycol) on the silicate dispersion and local order of rubber network, *Europhean Polymer Journal*, *44*(11), pp. 3493-3500.

36. Carter, L., Hendricks, J.G., Bolley, D.S & The national lead Co 1950, Elastomer reinforced with a modifie clay, US Patentent 2531396150.

37. Chakraborty, A., Basak, S., (2008). Effect of surfactants on casein structure: a spectroscopic study, *Biointerphases*, *63*(1), 83-90.

38. Chattopadhyay, P.K., Basuli, U., Chattopadhyay, S., (2010). Studies on navel dual filler based exfoliated natural rubber nanocomposites, *Polymer Composites*, *31*(5) pp. 835-846.

39. Chazeau, L., Cavaille J.Y., Canava, G., Dendievel, R., Boutherin, B., (1999). Viscoelasic properties of plastcized pvc reinforced with cellulose whiskers, *Applied Polymer Science*, *71*(11), pp. 1797-1808.

40. Chen, C.W., Higashi, M., Naito, T., Akashi, M. (2001). Size-selective synthesis of CdS nanoarticles on polyethylene films. *Chemistry Letters*, *20*(9), pp.870-871.

41. Choi, Y.S., Chung, I.J., (2008). Comprehending polymr-clay nanocomposites and their future works, *Korean Chemical Engineering Research*, *46*(1), pp. 23-36.

42. Chou, C.C., Chang, Y.C., Chiang, M.L., Lin, J.J., (2004). Conformational change of trifunctional poly (Oxypropylene) amines intercalated with a layered silicates confinement, *Maromolecules*, *37*(2), pp. 473-477.

43. Chow, W.S., Neoh, S.S., (2009). Dynamic mechanical thermal and morphological properties of silane treated montmorillonite reinforced polycarbonate nanocomposites, *Journal of Applied Polymer Science*, *114*(6), pp. 3967-3975.

44. Cornish K., Castillon J., Scott D.J. (2000). Rubber molecular weight regulation, in vitro, in plant species that produce high and low molecular weights in vivo. *Biomacromolecules*, *1*(4). pp. 632-641.

45. Cornish K., Wood D.F., Windle J.J. (1999). Rubber particles from four different species, examined by transmission electron microscopy and electron-paramanatic-resonance spin labeling, are found to consist of a homogeneous rubber core enclosed by a contiguous, monolayer biomembrane. *Planta, 210*(1): 85-96.

46. Dannenberb E.M. (1975). The effect of surfacce chemical interactions on the properties of filler-reainforced rubbers, *Rubber Chemistry and Technology, 48*(3): 410-444.

47. Das, A., Werner, K., Jurk, R., Jehnichen, D., Henrich, G., (2011). A general approch to rubber-montmorillonite nanocomposites: intercalation of stearic acid, *Applied Clay Science, 51*(1-2), pp. 117-125.

48. Datta, R.N., (2001). *Rubber curing system*, Rapra review reports, Rapra Technology Ltd, volume 12, pp. 3-26.

49. Deller, M., Kong, L., Rupp, B., (2016). Protein Stability: a crystallographer's perspective, *Acta Crystallographica, 72*(2), pp. 72-95.

50. Dietsche, F., Thomann, Y., Thomann, R., Mulhaupt, R.J., (2000). Translucent acrylic nanocomposites containing anisotropic laminated nanoparticles derived from intercalated layered silicates, *Applied Polymer Science, 75*(3), pp. 396-405.

51. Dresselhaus, M.S., Endo, M., (2001). In: Relation of carbon tubes to other carban materials, Dresslhaus, M.S., Dresselhaus, G., Avouris, P., (eds). Carbon nanotubes: synthesis, structute, prperties and applications, *Topics of Applied Physics,* vol 80, Springer-Verlag, Heidelberg, pp. 11-28.

52. Duy N.Q., Bich N.N. (2009). Nanocomposite from natural rubber latex and organoclay by dipersion destabilization. *Nanocomposite of natural rubber and organoclay*. Rubber research institute of Vietnam. pp. 1-5.

53. Ehabe E.J., Bonfils F. (2014). Novel insight into the gel phase of hevea natural rubber. *Journal of rubber research*, 14(1), pp, 1-10.

54. Ellis, B., Welding, G.N., (1964). Estimation from swelling of the structural contribution of chemical reactions to the vulcanization of natural rubber II. Estimation of equlibrium degree of swelling, *Rubber Chemistry and Technology*, *37*(2), pp. 571-575.

55. Ewulonu, C.M., Obele, C.M., Arukalam, I.O., Odera, S.R., (2015). Effect of local clay incorporation technique on the mechanical properties of natural rubber vulcanizates, *International Journal of Applied Sciences and Engineering Research*, *4*(3), pp. 307-320.

56. Fathurrohman, M.I., Soegijono, B., Budianto, E., Rohman, S., Ramadhan, A., (2015). The effect of organoclay on curing characteristics, mechanical properties, swelling and morphology of natural rubber/ organoclay nanocomposites, *Macrpmolecular Symposia*, *353*(1), pp. 62-69.

57. Fathurrohman, M.T., Rugmis, S., Hayeemasae, N., Sahakaro, K., (2019). Dispersion and properties of natural rubber-montmorillonites nanocomposites fabricated by novel in situ organo modified and latex compounding method, *Polymer Engineering and Science, 59*, pp. 1830-1839.

58. Favier, V., Gavaille, J.Y., Canova, G.R., Shirivastava, S.C., (1997). Mechanical percolation in cellulose whisker nanocomposites, *Polymer Engineering and Science*, *37*(10), pp. 1732-1739.

59. Finocchio, E., Baccini, I., Cristiani, C., Dotell, G., Stampino, P.G., Zampori, L., (2011). Hybrid organo-inorganic clay with nonionic interlayers. Mid and near IR spectroscopic, *The Journal of Physical Chemistry A*, *115*(26), pp. 7484-7493.

60. Flory P.J, Rehner, J.R., (1943). Statistical mechanics of cross-linked polymer networks II. Swelling. *Journal of Chemical Physics*, *11*(11), pp. 521-526.

61. Fox, D.M., Maupin, P.H., Harris, R.H., Gliman, J.W., Eldred D.V., Katsoulis, D., Trulove, P.C., Delong, H.C., (2007). Use of a polyhedral oligomeric sisesquioxane (Poss) imizazolium cation as organic modifier for montmorillonite, *Langmuir*, *23*(14), pp. 7707- 7014.

62. Fukushima, Y., Okada, A., Kawasumi, M., Karauchi, T., (1988). Swelling behaviour of montmorillonite by poly-6-amide, *Clay Minerals*, *23*(1), pp 27-34.

63. Galimberti, M., Senatore, S., Lostritto, A., Giannini, L., Conzatti, L., Costa, G., Guerra, G., (2009). Reinforcement of diene elastomers by organically modified layered silicates, *e-Polymer*, *9*(1). pp. 1-16.

64. Galimberti, M., (2011). *Rubber-clay nanocomposites; science, technology and applications*, John Wiley and Sons Inc, New York, PP. 28-36.

65. Ganter, M., Gronski, W., Reichert, P., Mulhaupt, R., (2001). Rubber nanocomposites: Morphology and mechanical properties of BR and SBR vulcanizates reinforced by organophilic layered silicates, *Rubber Chemistry and Technology*, *74*(2), pp. 221-235.

66. Gardolinski, J.E., Carrera, L.C.M., Canto, M.P., Wypych, F., (2000). Layered polymer-kanlinite nanocomposite, *Journal of Material Science*, *35*(2), pp. 3113-3119.

67. Ghari, H.S., Jalali-Arani, A., (2016). Nanocomposites based on natural rubber, organoclay and nano-calcium carbonate: Study on the structure, cure behaviour, static and dynamic-mechanical properties, *Applied Clay Science*, *119*(2), pp. 348-357.

68. Giannelis, E.P., (1996). Polymer layered silicates nanocomposites, *Advanced Materials*, *8*(1), pp. 29-35.

69. Giger, G., Liponski, M., (1957). Melanges-maitres de caoutchouc et dArgile, *Revue Generale du cautchouc*, *34*, pp. 473-477.

70. Glosh, P., Katare, S., Patkar, P., Caruthers, J.M., Venkatessubramanian, V., (2003). Sulphur vulcanization of NR for benzothiazole accelerated formulations: from reaction mechanism to rational kinetic model, *Rubber Chemistry and Technology*, *76*(3), pp. 592-693.

71. Goerl, U., Hunsche, A., Muller, A., Koban, H.G., (1997). Investigation into the silica/ silane reaction system, *Rubber Chemistry and Technology*, *70*(4), pp. 608-623.

72. Goh, S.H., Phang, K.W., (1978). Thermoanalytical studies of rubber oxidation catalysed by metallic ions, *Thermochemica Acta*, *25*(1), pp 109-115.

73. Gu, Z., Song, G., Liu W., GaO, P., Li H., Hu X. (2009). Preparation and properties of styrene butadiene rubber/natural rubber/organo-bentonite nanocomposites prepared from latex dispersions. *Applied clay science*, *46*(3). pp. 241-244.

74. Guegan, R., (2010). Intercalation of nonionic surfactant ($C_{10}E_3$) bilayer into a Na-montmorillonite clay, *Langmuir*, *26*(24), pp. 19175-19180.

75. Guggenheim, G., (n.d). *Introduction to the properties of clay materials*, [online] Avalable from: http:// minsocam.org/msa/monographs [Accessed 26th may 2019].

76. Guo, F., Aryana, S., Han, Y., Jiao, Y., (2018). A review of the synthesis and applications of polymer-nanoclay composites, *Applied Sciences*, *8*(9), pp. 1696-1725.

77. Gunister, E., Isci, S., Alemdar, A., Gungor, N., (2004). Effect of sodium dodecyl sulfate on flow and electrokinetic properties of Na-activated bentonite dispersions, *Bulletin of materials science*, *27*(3), pp. 317-322.

78. Hakim, R.N., Ismail, H., (2009). Compositon of the effect of organoclay loading on curing and mechanical properties of organoclay-filled epoxidsed

natural rubber nanocomposites and organoclay-filled natural rubber nanocomposites, *Journal of Physical Science*, *20*(2), pp. 37-39.

79. Harahap, H., Surya, E., Surya, I., Ismail, H., Azahari, B., (2014). Effect of leaching treatment on mechanical properties of natural rubber latex products filled modified kaolin, *Applied Mechanics and Materials*, *548-549*, pp. 90-95.

80. Hasma, H., Othman, A.B., (1990). Role of some non-rubber constituents on thermal oxidative ageing of natural rubber, *J.nat.Rubb.Res*, *5*(1), pp. 1-8

81. Heideman, G., Datta, R.N., Noordermeer, J.W.N., Baarle, B.N., (2004). Activators in accelerated sulphur vulcanization, *Rubber Chemistry and Technology*, *77*(3), pp. 512-541.

82. Ho, C.C., Kondo T., Muramatsu N., Ohshima H. (1996). Surface strucure of natural rubber latex particles from electophoretic mobility data. *Journal of Colloidal interface science*,*178*(2): 442-445.

83. Hofman W. (1989). *Rubber Technology Handbook*, Hanser Publishers, Munich, P 284.

84. Hrachova, J., Komadel, P., Jochec-Moskova, D., Krajci, J., Janogova, I., Slouf, M., Chodak, I., (2013). Properties of organoclay natural rubber nanocomposites: Effect of organophillic modifiers, *Journal of Applied Polymer Science*, *127*(5), pp. 3447-3455.

85. Huskic, M., Zagar, E., Zigon, M., Brnardic, I., Macan, J., Ivankovic, M. (2009). Modification of montmorillonite by cationic polyester, *Applied Clay Science*, *43*(3-4), pp. 420-424.

86. Hwang, W.G., Wei, K.H., Wu, C.M., (2004). Preparation and mechanical properties of nitrile butadiene rubber/ silicate nanocomposite", *Polymer*, *45*(16), pp. 5729-5734, 2004.

87. Ishiaku, U., Chong, C., Ismail, H., (2000). Cure characteristics and vulcanizate properties of a natural rubber compound extended with convoluted rubber powder, *Polymer Testing*., *19*(5), pp 507-521.

88. Ishida, H., Ohba, S., (2005). Synthesis and characterization of maleimide and nobornene functionalized of maleimide and nobornene functionalized benzoxazines, *Polymer*, *46*(15), pp. 5588-5595.

89. Ishikawa, W., (2011). Systematic review of tire technology, *National Museum of Nature Science*, *16*, pp. 131

90. Ismail, N.I.N., Veerasamy, D., (2011). Value-added natural rubber skim latex concentrate/ montmorillonite as envirnmentally frendly nanocomposite materials, *Journal of Rubber Research*, *14*(4). Pp. 216-219.

91. Jacob, A., Kurian, P., Aprem, A.S., (2007). Cure characteristics and mechanical properties of natural rubber layered clay nanocomposites, *International Journal of polymeric materials and polymeric bomaterials*, *56*(6), pp. 593-604.

92. Jang, K.H., Kim, E., Jeon, Y.H., Yoon, J., (2012). Clay modification with silane compounds and characteristion of the silicon rubber/ clay composites, *Journal of Polymer Engineering*, *32*(8-9), pp.493-502.

93 Jelinska, A., Zagozdzon, A., Gorecki, M., Wisniewska, A., Frelek, J., Holyst, R., (2017). Denaturation of proteins by surfactants studied by taylor dispersion analysis, *PLOSONE*, 12(4), pp. 1-11.

94. Jeon, H.S., Rameshwaram, J.K., Kim, G., Weinkaul, D.H., (2003). Characterization of polyisoprene-clay nanocomposites prepared by solution blending, *Polymer*, *44*(19), pp. 5749-5758.

95. Joly, S., Garnaud, G., Ollitrault, R., Bokobza, I., Mark J.E., (2008). Organically modified layered silicates as reinforcing fillers for natural rubber, *Chemistry of Materials*, *14*(10), pp. 4202-4208.

96. Juntuek, P., Rukakulpiwat, C., Chumsamrong, P., Ruksapulpiwat, Y., (2012). Effect of glycidyl methacrylate-grafted natural rubber on physical properties of polylactic acid and natural rubber blends, *Applied Polymer Science*, *125*(1), pp. 745-754.

97. Jurkowska, B., Jurkowski, B., Oczkowski, M., Presetskii, S.S., Koval, V., Olkhov, Y.A., (2007). Properties of montmorillonite-containing natural rubber, *Journal of Applied Polymer Science*, *106*(1), pp. 360-371.

98. Kaewkumay, C., Jarukumjorn, K., Suppakarn, N., (2010). Effect of surfactant content and clay content on propertes of NR nanocomposites, *Advance Materials Research*, *123-125*, pp. 55-58.

99. Kaewkumay, C., Jarukumijorn, K., Wittayakun, J., Suppakarn, N., (2012). Influences of surfactant content and type on physical properties of natural rubber/organoclay nanocomposites, *Journal of polymer reserarch*, *19*(7), pp. 1-9.

100. Kaewsakul, W., Sahakaro, K., Dierkers, W.K, Noordermeers, J.W.M., (2015). Mechanical aspects of silane coupling agent with different functionalities on reinforcement of silica-filled NR compounds, *Polymer Engineering and Science*, *55*(4), pp.836-842.

101. Kajima, Y., Usuki, A., Kawasumi, M., Okada, A., Fukushima, Y. (1993a). Mechanical properties of nylon 6-clay hybrid. *Journal of Material Research*. *8*(5), PP.1185-1189.

102. Kajima, Y., Usuki, A., Kawasumi, M., Okada, A., Karauchi, T., Kamigaito, O., (1993b). Sorption of water in nylon 6-clay hybrid, *Journal of Applied Polymer Science*, *49*(7), pp. 1259-1264.

103. Karger-Kocsis, J., Wu, C.M., (2004). Thermoset rubber/ layered silicate nanocomposites. status and future trends, *Polymer Engineering and Science*, *44*(6), pp. 1083-1093.

104. Kannika, S., Beraheng, S., (2008). Reinforcement of maleated natural rubber by precipitated silica, *Journal of Applied Polymer Science*, *109*(6), pp. 3839-3848.

105. Kawasumi, M., Hasegawa, N., Kato, M., Usuki, A., Okada, A., (1997). Preparation and mechanical properties polypropylene clay hybrids, *Macromolecules*, *30*(20), pp. 6333-6338.

106. Khalid, M., Walvekar, R., Ketabchi, M.R., Siddiqui, H., Hoque, M.E., (2016). Rubber/ nanoclay composites: towards advanced functional materials, *Nanoclay reinforced polymer composites*, Singapore, Springer, PP. 209-224.

107. Kim C., Beuve J.S, Guilbert S., Bonfils F. (2009). Study of chain branching in natural rubber using size-exclusion chromatograpy coupled with a multi-angle light scattering detector (SEC-MALS). *Europhian Polymer Journal* 45(8): 2249-2259.

108. Kim, E., Kim, E.J., Lee, T.H., Yoon, J., (2011). Clay modification and its effect on the physical properties of silicon rubber/ clay composites, *Journal of Applied Polymer Science*, *125*(S1), pp. 298-30.

109. Kim, W., Kim, S.K., Kang, J., Choe, Y., (2006). Structure and properties of the organoclay filled NR/BR nanocomposites, *Macromolecular Research*, *14*(2), pp. 187-193.

110. Kim, W.S., Paik, H.J., Base, J.W., Kim, W. (2011). Effect of polyethylene glycol on the properties of styrene-butadiene rubber/organo clay nanocomposites filled with silica and carbon black. *Journal of Applied Polymer Science*, *122*(3), pp. 1766-1777.

111. Kita, Y., Kishino, K., (1998). New process for manufacturing maleimides, *Catalysis survays from Japan*, PP 187-198.

112. Kornmann, X., Berglund, L.A., Sterte, J., (1998). Nnocomposites based on montmorillonite and unsaturated polyester, *Polymer Engineering and Science*, *38*(8), pp. 1351-1358.

113. Lagaly, G., Ogawa, M., Dekany, I., (2013). Clay mineral-organic interactions. in *Development in clay science*, vol.5, pp. 435-505.

114. Lan, T., Padmananda, D., Kaviatne, D., Pinavaia, T.G., (1994). On the nature of polyimide-clay hybrid composites, *Chemistry of Materials*, *6*(5), pp. 573-575.

115. Lapattananon, N., Jitkalong, D., Seadan, M., (2011). Hybridized reinforcement of natural rubber with silane modified short cellulose fibers and silica, *Journal of Applied Polymer Science*, *120*(6), pp. 3242-3254.

116. Lebrun, J.J, Porte, H., *Comprehensive polymer science and supplements* (1989). Geoffrey, A., Bevington, J.C.,(eds), Elsevier Ltd, vol 5, PP. 593-609.

117. Lee, C.W., Hwang, T., Nam, G., Hong, J.P., Lee D.A., Ohj, S., Kwak, S.B., Lee, S.H., Lee, W.S., Yang, K.M., Park, J.M., Lee, Y.S., Chung, K.H., Lee, Y., Choi, H.R., Nam, J.D., (2011). A novel synthetic route to natural rubber/ montmorillonite nanocomposite using colloid stabilation-destabilization method, *Composites: Part A*, *42*(11), pp. 1826-1832.

118. Lent, L., Vanasupa, L., Tong, P., (1998). Whey protein edible film structures determined by atomic force microscope, *Journal of Food Science*, *63*(5), pp. 824-827.

119. Li, P., Wang, L., Song, G., Yin, L., Qi, F., Sun, L., (2008). Characterization of high-performance exfoliated natural rubber/ organoclay nanocomposites, *Journal of Applied Polymer*, *109*(6), pp. 3831-3838.

120. Liao, Y.L., Chiu, C.W., Lin, J.J., (2010). General intercalation of poly(oxyalkylene)-amidoacids for anionic and cationic layered clays, *Industrial & Engineering Chemistry Research*, *49*(10), pp. 5001-5005.

121. Lin, J.J., Chang, Y.C., Chang, I.J., (2004). Novel mechanism for layered silicate clay intercalation by poly(polypropylene oxide)-segmented carboxylic acid, *Macromolecular Rapid Communications*, *25*(3), pp. 508-512.

122. Ling, Y., Long, J., Huang C., (2016). Preparation and modification of polythiophene – organic montmorillonite composite, Polymer Composites, 37(8), PP. 2503-2510.

123. Liu, L., Luo, Y., Jia, D., Fu, W., Guo, B., (2006). Structure and properties prepared of natural rubber organoclay nanocomposites prepared by grafting and intercalating method in latex, *Journal of Elastomers and Plastics*, *38*(), pp. 147-161.

124. Liu, Y., Li, L., Wang, Q., (2010). Effect of carbon black/ nanoclay hybrid filler on the dynamic properties of natural rubber vulcanizates, *Journal of Applied Polymer Science*, *118*(2), pp. 1111-1120.

125. Lopez-Manchado, M.A., Arroyo, M., Herrero, B., Biagiotti, J., (2003). Vulcanization kintics of natural rubber-organo clay nanocomposites, *Journal of Applied Polymer Science*, *89*(1), pp. 1-15.

126. Lopez-Manchado, M., Herrero, B., Arroyo, M., (2004). Organoclay-natural rubber nanocomposites synthesized by mechanical and solution mixing method, *Polymer International*, *53*(11), pp. 1766-1772.

127. Lorenz, O., Parks, C.R., (1961). The crossliking efficiency of some vulcanizing agents in natural rubber, *Journal of Polymer science*, *50*(154), pp. 299-312.

128. Lorenz, J.P., (1976). N-(aminothio)imide cure modifiers, *Rubber Chemistry and Technology*, *49*(2), pp. 333-340.

129. Luginsland, H.D., (2000). Reactivity of the sulphur chains of tetra sulfane silane si69 and the disulfane silane TESPD, *Kautschuk and Gummi Kunststoffe*, *53*, pp. 10-23.

130. Madhusoodanan, K.N., Verghese, S., (2006). Technological and processing properties of natural rubber layered silicate-nanocomposites by melt intercalation process, *Journal of Applied Polymer Science*, *102*(3), pp. 2537-2543.

131. Magaraphan, R., Thaijaroen, W., Lim-Ochakun, R., (2003). Structure and properties of natural rubber and modified montmorillonite nanocomposites, *Rubber Chemistry and Technology*, *76*(2), pp. 406-415.

132. Manzur, A., Rubio., L., (1997). Strain-induced crystallization in cis and trans polyisoprene blends: Effect of molecular weight of trans PI, *Journal of macromolecular science Part B, 36*(1), pp.

133. Mao, L., Xiang, G., Zhange, M., Jin, R., (2006). Polycarbonate/ polypropylene/ fibrillar silicates ternary nanocomposites via two-step blending process: degradation and morphology, *Chinese Journal of Chemical Engineering, 14*(2), pp. 248-252.

134. Marini, J., Bretas, R.E.S., (2013). Influnce of shape and surface modification of nanoparticle on the rheological and dynamic-mechanical properties of polyamide 6 nanocomposites, *Polymer Engineering and Science*, *53*(7), pp. 1512-1528.

135. Mark, J.E., (1996). Ceramic-reinforced polymers and polymer-modified cersmics, *Polymer Engineering and Science*, *36*(24), pp. 2905-2920.

136. Martin, G., Davey, W.S., (1934). Rubber from latex coagulated with sulphric acid, *Journal of rubber reserch institute of Malaysia*, 5(3), pp. 282-294.

137. Matayabas, J., Turners, S., In Pinnavaia, Beall, G., (Eds). (2001). *Polymerclay nanocomposites*. John Wiley and Son, New york, P.207.

138. Nicholas, A., Matwiyoff, N.A., Drago, R.S., (1965). Donor and acceptor properties of some trisubstituted oxy compounds of the group IV elements, Journal of organometallic chemistry,3(5), pp. 393-399.

139. Maslowski, M., Miedzianowska, J., Strzeleck, K., (2019). Natural rubber composites filled with crop residues as an alternative to vulcanizates with common fillers, Polymers, 11(6), 972

140. Medalia A.I., Kraus G. (1994). *Science and Technology of Rubber*. Eds. Mark B., Erman B., Enrich R.F, Acadamic Press, New York, p 387.

141. Messersmith, P.B., Giannelis, E.P., (1994). Synthesis and characterization of layered silicate-epoxy nanocomposites. *Chemistry of Materials*, *6*(10), pp. 1719-1725.

142. Messersmith, P.B., Giannelis, E.P., (1995). Synthesis and barrier properties of poly(Ɛ- caprolactane)- layered silicate nanocomposites, *Journal of Polymer Science Part B Polymer Physics*, *33*(7), pp. 1047-1057.

143. Ming, H., Chen, H., Shen, Z., Lin, S., (2002). Preparation and characterization of maleic anhydride-functionlized syndiotactic polystyrene, *Polymer*, *43*(20), pp. 5455-5461.

144. Miranda-Trevino, J.C., Coles, C.A., (2003). Kaolinte properties, structure and influence of metal retention on pH, *Applied Clay Science*, 23(1-4), pp. 133-139.

145. Moczo, J., Punanszky, B., (2008). Polymer micro and nanocomposites: *Journal of industrial and Engineering Chemistry*, *14*(5), pp. 535-563.

146. Mohan, T.P., Kuriakose, J., Kanny, K., (2011). Effect of nanoclay reinforcement on structure, thermal and mechanical propeties of natural rubber-styrene butadiene rubber (NR-SBR), *Journal of Industrial and Engineering Chemistry*, *17*(2), pp. 264-270.

147. Morrison, N.J., (1984). Reactions of crosslink precursors, *Rubber Chemistry and Technology*, *57*(1), pp. 86-96.

148. Mousa, A., Kager-Kocsis, J., (2001). Rheological and thermodynamical behaviour of styrene/ buitadiene rubber-organoclay nanocomposites, *Macromolecular materials and Enginering*, *284*(4), pp. 260-266.

149. Nah, C., Ryu, H.J., Han S.H., Rhee J.M, Lee, M., (2001). Fracture behaviour of acrylonitrile-butadiene rubber/clay nanocomposites, *Polymer International*, *20*(11), pp. 1265-1268.

150. Nakason, C., Kaesaman, A., Supasanthitikul, P., (2003). The grafting of maleic anhydride onto natural rubber, *Polymer Testing*, *23*(1), pp. 35-41.

151. Nakason C., Sookyung U., Vennemann N., Thaijaroen.W. (2015). *Acid free preparation of natural rubber/ clay nanocomposite*. Society of plastic Engineering. Avalable at http:/w.w.w.4spepro.org, Accessed 23 April 2016.

152. Nawamawat K., Sakdapipanich T.T., Ho C.C., Ma Y., Song J. (2011). Surface nanostructure of Havea brasiliensis, natural rubber latex particles. *Colloids Surfaces A*, 390 (1-3): 157-166.

153. Nematollahi, M., Jalali-Arani, A., Golzark, K., (2014). Organoclay maleated natural rubber nanocomposite. prdiction of a abresion and mechanical properties by artificial neural network and adaptive neuro-fuzzy inference, *Applied Clay Science*, *97-98*, pp. 187-199.

154. Okada, A., Usuki, A., Kurauchi, T., Kaminggaito, O., in *hybrid organic-inorganic composites* (1995). Mark, J.E., Lee, C.Y.C, Bianconi, P.A., (eds), ACS symposium Series, American Chemical Society, Washington, vol 585, PP. 55-65.

155. Okada, A., Usuki, A., (1995). The chemistry of polymer-clay hybrids, *Material Science and Engineering:C*, *3*(2), pp. 109-115.

156. Paiva, L.B., Morales, A.R., Francisco, R., Diaz, V., (2008). Organoclay: properties, preparations and applications, *Applied Clay Science*, *42*(1-2), pp. 8-24.

157. Park, J., Lee, Y.S., Lee, C.W., Yang, Y., Lee, J., Nam G., Lee, S., Lee, Y.S., Lee, Y., Nam, D., (2012). Montmorillonite reinforced natural rubber nanocomposites through emulsion stabilization destabilization method, *Rubber Chemistry and Technology*, *85*(2), pp-165-179.

158. Pinnavaia, T.J., Beall, G.W., (2001). Polymer-Clay nanocomposites, John Wiley and Sons Ltd, New York, pp. 3-9.

159. Pongnara, P., Poonsawat, C., Amnuaypanich, S., (2008). Adsorption study of surfactant on natural rubber latex particles, *Asia-Pacfic Journal of Science and Technology*, *13*(6), pp. 694-700.

160. Premachandra, J., Kumudinie, C., Zhao,W., Mark, J.E., Dang, T.D., Chen, J.P., Arnold F.E., (1996). Polymer-silica hybrid materials prepared from some functionlized polybenzoxazoles and polybenzobisthiazoles, *Journal of Sol-Gel Science and Technology*, *7*(3), pp. 163-175.

161. Pramanik, M., Srivastava, S.K., Samantaray, B.K., Blowmick, A.K., (2003). Rubber-Clay nanocomposites by solution blending, *Applied Polymer Science*., *87*(14), pp. 2216-2220.

162. Qu, L., Huang, G., Liu, Z., Zhange, P., Weng, G., Nie, Y., (2009). Remarkable reinforcement of natural rubber by deformation-induced crystallization in the presence of organophilic montmorillonite, *Acta Materialia*, *57*(17), pp. 5053-5060.

163. Qureshi, M.N., Qammar, H., (2010). Mill processing and properties of rubber-clay nanocomposites, *Material Science and Engineering:C*, *30*(4), pp. 590-596.

164. Rajasekar, R., Heinrich, G., SI, A., SI, C.K., (2009). Development of SBR-Nanoclay composites with epoxidized natural rubber as compatibilizer, *Research Letters in Nanotechnology*, *405153*, pp. 1-5.

165. Ratnayake, U.N., (2003a). Ribbed smoked sheet, In Tilakeratne, L.M.R., Nugawela, A., Seneviratne, W.M.G., (eds.). *Hand book of rubber*, Rubber Research Institute of Sri Lanka, Darton field, Agalawatta, pp. 15-32.

166. Ratnayake, U.N., (2003b). Water used in raw rubber manufacture In Tilakeratne, L.M.R., Nugawela, A., Seneviratne, W.M.G., (eds.). *Hand book of rubber*, Rubber Research Institute of Sri Lanka, Darton field, Agalawatta, pp. 134-139.

167. Ratnayake U.N., Kumara P.H.S., Siriwardena T.A.S., Prasad A.K.D.W., Rohanadeepa, V.C., (2011). Effect of iron in processing water in quality of crepe rubber rubber, *Journal of Rubber Research Institute of Sri Lanka, 91*, pp. 1-14.

168. Ratnayake, U.N., Premathunga, D.E., Peris, C., Karunaratne, V., Amarathunga, G.A., (2015). Polyethylene glucol-intercalated organoclay on vulcanization characteristics and reinforcement of natural rubber nanocomposites, *Journal of Elastomer and Plastics*, *48*(8), pp. 711-727.

169. Rattanasom, N., Thammasiripong, U., Suchiva, K. (2005). Mechanical properties natural rubber in comparision with synthetic cis-1,4 polyisoprene vulcanizates: Gum and blacked-filled vulcanizates. *Journal of Applied Polymer Science*, 97(3): 1139-1144.

170. Rattanasom S., Prasertsri S & Ruangritnumchai T. (2009). Comparison of the mechanical properties at similar hardness level of natural rubber filled with various reinforcing-fillers. *Polymer Testing* 28(1). pp. 8–12.

171. Ray, S.S., Yamada, K., Okamoto, M., Fugimoto, Y., Ogami, A., Ueda, K., (2003 a). New polylactide/ layered silicate nanocomposites.5. Designing of materials with desired properties, *Polymer*, *44*, pp. 6633-6646.

172. Ray, S.S., Okamoto, K., Okamoto, M., (2003 b). Structure-property relationship in biodegradable poly(butylene succinate)/ layered silicate nanocoposites, *Macromolecules*, *36*(7), pp. 2355-2367.

173. Ray, S.S., Okamoto, M., (2003). Polymer/ layered silicates nanocomposites: a riview fom preparation to processing, *Progress in Polymer Science*, *28*(11), pp. 1539-1641.

174. Reichert, P., Kressler, J., Thomann, R., Mulhaupt, R., Stoppelman, G., (1998). Nanocomposites based on a synthetc layer silicate and polyamide-12, *Acta Polymerica*, *49*(2-3), pp. 116-123.

175. Reuvekam, L.A.E.M., Brinke, J.W.T., Swaaij, P.J., Noordermeer, J.W.M., (2002). Effect of time and temperature on the reaction of TESPT silane coupling agent during mixing with silica filler and tire rubber, *Rubber Chemistry and Technology*, *75*(2), pp. 187-198.

176. Rezende, C.A., Braganca, F.C., Doi, T.R., Lee, L., Galebeck, F., Baue, F., (2010). Natural rubber clay nanocomposites: mechanical and structural properties, *Polymer Journal*, *51*(16), pp. 3644-3652.

177. Rippel, M.M., Leite, C.A.P., Galembeck, F., (2002). Elemental mapping in natural rubber latex films by electron energy loss spectroscopy associated with transmission electron mocroscopy, *Analytical Chemistry*, *74*, pp. 2541-2548.

178. Rippel, M.M., Lee, L.T., Leite, C.A.P., Galembeck, F., (2003). Skim and cream natural rubber particles: colloidal properties, coalescence and film formation, *Journal Collioid Interface Science*, *268*, pp. 330-340.

179. Rodriguez, J., Hamed, G.R., (1993). Styrene-Buitadiene Rubber filled with fluorinated Carbon black. *Rubber Chemistry and Technology*, *66*(2), pp. 286-294.

180. Rooj, S., SI, A., Stockelhuber, K.W., Mukhopardhyay, N., Bhattacharyya, A.R., Jehnichen, D., Heinrich, G., (2012). Pre-intercalation of long chain fatty acid in the interlayer space of layered silicates and preparation of montmorillonite/ natural rubber nanocomposites, *Applied Clay Science*, *67-68*, pp. 50-56.

181. Sadhu, S.D, Blowmick, A.K., (2004). Preparation and properties of styrene-butadiene rubber based nanocomposites: the influence of the structural and processing parameters, *Journal of Applied Polymer Science*, *92*(2), pp. 698-709.

182. Sadhu,S.D, Rajeev R.S., Bhowmick, A.K., (2008). Thermal degradation of elastomer based nanocomposites, *Polymer & Polymer Composites*, *16*(5), pp. 283-293.

183. Saelao, J., Phinyocheep, P., (2005). Influence of stryrene on grafting efficiency of maleic anhydride on to natural rubber, *Journal of Applied Polymer Science, 95*(1), pp. 28-38.

184. Sae-oui, P., Sirisinha, C., Hattahapanit, K., Thessuwan, U., (2005). Comparision of reinforcing efficiency between si-69 and si-264 in an efficient vulcanization system, *Polymer Testing 24*(4), pp. 439-446.

185. Sae-oui, P., Sirisinha, C., Thepsuwan, U., Hatthapanit, K., (2006). Roles of silane coupling agents on properties of silica coupling agents on properties of silica-filled polychloreprene, *European Polymer Journal*, *42*(2), pp. 479-486.

186. Saha, D., Ray, D., Kohlbrecher, J., Aswal, V.K., (2018). Unfolding and refolding of protein by a combination of ionic and non ionic surfactants, *ACS Omega*, *3*, pp. 8260-8270.

187. Sakdapipanich J.T., (2007). Structural characterization of natural rubber based on recent evidence from selective enzymatic tratments, *Journal of bioscience and bioengineering,103*(4), pp. 287-292.

188. Santipanuscopon.S., Riyajan.S., (2009). Effect of field natural rubber latex with different ammonia contents and storage period on physical properties of latex concentrate, stability of skim latex and dipped film, *Physics Procedia*, *2*, pp. 127-134

189. Sarkawi, S.S., Dierkes, W.K., Noordermeer, J.W.M., (2013). The influence of non-rubber constituents on performance of silica reinforced natural rubber compounds, *European Polymer Journal*, *49*(10), pp. 3199-3209

190. Selleh, M.Y.B., (2010). The effect of carbon black loading on tensile strength of rubber vulcanizates, Degree of Bachelor of Chemical Engineering, University Malaysia Pahang, Available at https://core.ac.uk/download/pdf/157179161pdf

191. Seneviratne, W.M.G., Kumara, P.H.S., (2003). Centrifuged latex In Tilakeratne, L.M.R., Nugawela, A., Seneviratne, W.M.G., (eds.). *Hand book of rubber*, Rubber Research Institute of Sri Lanka, Darton field, Agalawatta, pp. 80-82.

192. Sengloyluan, K., Sahakaro, K., Dierkes, W.K., Noordermeer J.W.N., (2017). Silane grafted natural rubber and its compatibilization effect on silica-reinforced rubber tire compounds, *EXPRESS Polym. Lett*, *11*(12), pp. 1003-1022.

193. Sharif, J., Yunus, W.M.Z.W., HJ, K.Z., Dhhlan, M., Ahmad, M.H., (2005). Preparation and properties of radiation crosslinked natural rubber/ clay nanocomosites, *Polymer Testing*, *24*(2), pp. 211-217.

194. Sharif-Pakdaman, A., Morshedian, J., Jahani, Y., (2013). Effect of organoclay and silane grafting of polyethylene on morphology barrierity and rheological properties of HDPE/ PA 6 Blends, *Journal of Applied Polymer Science*, *127*(2), pp. 1211-1220.

195. Sharma, P.K., Upadhyaya, P., Chand, N., (2015). Effect of heat aging on mechanical performance of MMT clay reinforced thermplastic polyurethane (TPU)/ EPDM rubber blends based on nano composite, *Europhean Journal of advances in Engineering and Technology*, *2*(5), pp 23-26.

196. Singla. P., Mehta, R., Upadhyay, S.N., (2012). Clay modification by use of cations, *Green and Sustainable Chemistry*,*2*, pp. 21-25.

197. Sookyung, U., Nakason, C., Thijaroen, W., Vennemann, N., (2014). Influence of modifying agent of organoclay on properties of nanocomposites based on natural rubber, *Polymer Testing*, *33*(3), pp. 48-56.

198. Son, P.N., Andrews, K.E., Schooley, A.T., (1972). Kinetics and mechanism of the reaction of z-mercapto benzothiazole with N-(cyclohexylthio) phthalimide and related compounds, *Rubber chemistry and technology*, *45*(6), pp. 1513-1531.

199. Strawhecker, K.E., Manias, E., (2000). Structure and properties of poly (vinyl alcohol) / Na^+ montmorillonite nanocomposites, *Chemistry of materials*, *12*(10), pp.2943-2949.

200. Subramani, S., Choi. S.W., Lee, J.Y., Kim, J.H., (2007). Aqueous dispersion of novel silylated (polyurethane-acrylic hybrid/ clay) nanocomposite, *Polymer*, *48*(16), pp. 4671-4703.

201. Sukumar, R., Menon, A.R.R., (2008). Organomodified kaolin as a reinforcing filler for natural rubber, *Journal of Applied Polymer Science*, *107*(6), pp. 3476-3483.

202. Sun, Y., Luo, Y., Jia, D., (2008). Preparation and properties of natural rubber nanocomposites with solid-state organomodified montmorillonite, *Journal of Applied Polymer Science*, *107*(5), pp. 2786-2792.

203. Tan, J., Wang, X., Luo, Y., Jia, D., (2012). Rubber/ clay nanocomposites by combined latex compounding and melt mixing: A nanocomposite process, *Material and Design*, *34*, pp. 825-831.

204. Tan, J., Wang, X., Liu, Y., LuO, Y., Jia, D., Liu, Y., Xiong, Y., Wang, W., (2016). Effect of epoxidized natural rubber as compatibilizer on latex compounded natural rubber-clay nanocomposites, *Journal of Polymer Engineering*, *31*(1), pp. 43-52.

205. Tanaka Y., Sato H., Kageyu A. (1983). Structure and biosynthesis mechanism of natural Cis-Polyisoprene from goldenrod. *Rubber Chemistry and Technology* 56(2):299-303.

206. Tanaka Y., Mori M., Ute K., Hatada K. (1990). Structure and biosynthesis mechanism of rubber from fungi, *Rubber chemistry and Technology*, *63*(1):1-7.

207. Tangpakdee J., Tanaka Y. (1997) Purification of natural rubber. *Journal of Natural Rubber Research*, *12*(2), pp.112-119.

208. Tangpakdee J., Tanaka Y. (1998) Long-chain polyprenols and rubber in young leaves of hevea brasiliensis, *Phytochemistry*,*48*(3), pp. 447-450.

209. Tarachiwin L., Sakadapipanich J., Ute K., Kitayama T., Bamba T., (2005). Structural characterization of alpha-terminal group of natural rubber.2.Decomposition of branch-point by phosphatase and chemical treatments. *Biomacromolecules*, *6*(4), pp.1858-1863.

210. Tasban, N., Wirasates, S ., Suchiva, K., (2010). Abresion behaviour of layered siliate reinforced natural rubber, *Wear*, *269*(5-6), pp. 394-404.

211. Teh, P.L., Ishak, Z.A.M., Hashim, A.S., Karger-Kocsis, J., Ishiaku, U.S., (2004). On the potential of organoclay with resprct to convenctional fillers (carbon black, silica) for exfoliated natural rubber compatibilized natural rubber vulcanizates, *Journal of Applied Polymer Science*, *94*(6), pp. 2438-2445.

212. Teh, P.L., Ishak, Z.A.M., Hashim, A.S., Karger-kocsis, J., Ishiaku, U.S., (2005). Physical properties of natural rubber/ organoclay nanocomposites compatibilized with epoxidized natural rubber, *Journal of Applied Polymer Science*, *100*(2), pp. 1083-1092.

213. Theng, B.K.G., (1979). *Formation and properties of clay-polymer composites*, Elsevier, Amsterdam.

214. Theng, B.K.G., Bureau, S., Hutt, L., (1982). Clay-polymer interactions summary and perspectives, *Clay and Clay Minerals*, *30*(1), pp. 1-10.

215. Thomas, S., Stephen R., (2010)., *Rubber nanocomposites preparation, properties and applications*, John wiley and sons. Inc, New York, pp. 46-220.

216. Thongpin, C., Tangchantra, N., Kaewpetch, P., Dejkun, J., Chartsiriwattana, A., (2008). The effect of organic modifiction method on to montmorillonite on mechanical properties of natural rubber, *Advnced Material Research*, *55-57*, pp 341-344.

217. Tjong, S.C., (2006). Structural and mechanical properties of polymer nanocomposites, *Mater.Sci.Eng*, *53* (3-4), pp 73-197.

218. Tuampoemsab, S., Skadapipanich, J., (2007). Role of naturally occurring lipids and proteins on thermal ageing behavior of purified natural rubber, *KGK Rubber Point*, 60(12), pp. 678-684.

219. Tosaka, M., Farutani, M., Tsuji, M., Ikeda, Y., Kohjiya, S., Wititsuwannakul, G., Wititsuwannakul., D., Nagayama, K., Danev, R., (2009). Strain induced crystallization of fractionated natural rubber from fresh latex, *Journal of Society of Material Science Japan*, *58*(1), pp. 5-10.

220. Uddin, F., (2008). Nano clay, and montmorillonite minerals, *Metallurgical and Materials Transactions A*, *39*(12), pp 2804-2814.

221. Uddin, F., (2018). Montmorillonite: an introduction to properties and utilization, In Zoveidavianpoor, M., (eds.). *The current tropics in utilization of clay in industrial and midicinal application*, Intehopen.77987.

222. Unalan, I.U., Gerri, C., Marcuzzo, E., Cozzolino, C.A., Farris, S., (2014). Nanocomposites films and coatings using inorganic nanobuilding blocks (NBB): Current applications and future opportunities in food packaging sector, *RSC.Adv*, *4*, pp. 29393-29428.

223. Usuki, A., Koiwai, A., Kojima, Y., Kawasumi, M., Okada, A., Karauchi, T., Kamigaito, O., (1995). Interaction of nylon 6-clay surface and mechanical properties of nylon 6-clay hybrid, *Journal of Applied Polymer Science*, *55*(1), pp. 119-123.

224. Valadares, L.F., Leite, C.A.P, Galembeck, F., (2006). Preparation of natural rubber-momtmorillonite nanocomposite in aqeous medium: evidence for polymer platlet adhesion, *Polymer*, *47*(2), pp. 672-678.

225. Vaia, R.A., Ishil, H., Giannelis, E.P., (1993). Synthesis and properties of two dimentional nanostrutures by direct interaction of polymer melts in layered silicates, *Chemistry of Materials*, *5*(12), pp. 1694-1696.

226. Vaia, R.A, Price, R., Ruth, P., Nguyen, H., Lichtenhan. J., (1999). Polymer/ layered silicate nanocomposites as high performance ablative materials. *Applied Clay Science*, *15*(1-2), pp. 67-92.

227. Varghese, S., Karger-Kocsis, J., Gatos, K.G., (2003 a). Melt compound epoxidized natural rubber layered siicate nanocomposites: structure-properties relationships, *Polymer*, *44*(14), pp. 3977-3983.

228. Varghese, S., Karger-kocsis, J., (2003 b). Natural rubber-based nanocomposites by latex compounding with layered nanocomposites by latex compounding with layered silicates, *Polymer*, *44*(17), pp. 4921-4927.

229. Viana, R.B., Silva, A.B.F., Pimentel, A.S., (2012). Infrared spectroscopic of anionic, cationic, and Zwitterionic surfactants, *Advance in Physical Chemistry, 903272*, pp. 1-14.

230. Vieira, M.G.A., Silva, A., Santos, L.O.D., Beppu M.M., (2011). Natural – based plasticizers and biopolymer films: A review, *European Polymer Journal*, *47*(3), pp. 254-263.

231. Viet, C.X., Ismail, H., Rashid, A.A., Takeichi, T., Thao, V.H., (2008). Organoclay filled natural rubber nanocomposite: the effect of filler loading, *Polymer-Plastic Technology and Engineering*, *47*(11), pp. 1090-1096.

232. Vijayalekshmi, V., George, K.E., Pavithra, C., (2010). Studies on maleated natural rubber/ organoclay nanocomposites, *Progress in Rubber Plastic and RecyclingTechnology*, *26*(4), pp. 183-198.

233. Vu, Y.T., Mark, J.E., Pham, L.H., Engelhard, T.M., (2001). Clay nanolayer reinforcement of cis-1,4-polyisoprene and epoxidized natural rubber, *Journal of Applied Polymer Science*, *82*(6), pp. 1391-1403.

234. Wagner, M.P., (1976). Rainforcing silicas and silicates. *Rubber Chemistry Technology*, *49*(3). PP. 703-774.

235. Walter D. (2013). Primary particles-Agglomerates-Aggregates, Eds Deutshe Willey on line libry http:doi.org/10.1002/9783527673919.

236. Wang, M.S., Pinnavaia, T.J., (1998). Nanolayer reinforcement of elastomeric polyurethane, *Chemistry of Materials*, *10*(12), pp. 3769-3721.

237. Wang, Y., Zhang, L., Tang, C., Yu, D., (2000). Preparation and characterization of rubber clay nanocomposites, *Journal of Applied Polymer Science, 78*(11), pp. 1879-1883.

238. Wang, K.H., Xu, M., Choi, Y.S., Chung, I.J., (2001). Effect of aspect ratio of clay on melt extensional process of maleated polyehylene/clay nanocomposite. *Polymer Bulletin*, *46*(6), pp. 499-505.

239. Wang, Y., Zhang, H., Wu, Y., Yang, J., Zhang, L., (2005 a). Preparation and properties of natural rubber/ rectorite nanocomposites, *European Polymer Journal*, *41*(11), pp. 2776-2783.

240. Wang, J., Lu, D., Lin, Y., Liu, Z., (2005 b). How CTAB assists the refolding of native and recombinant lysozyme, *Biochemical Engineering Journal*, *24*(3), pp. 269-277.

241. Wen, J., Wikes, G.L., (1996). Organic/ inorganic hybrid network materals by sol-gel approach, *Chemistry of materials*, *8*(8), pp. 1667-1681.

242. Werne, T.V., Pattern, T.E., (1999). Preparation of structurally well-defined polymer-nanoparticle hybride with controlled/ living radical polymerizations, *Journal of american Chemical Society*, *121*(32) pp. 7409-7410.

243. Wloch, M., Ostaszewska, U., Datta, J., (2019). The effect of polyurethane glycolysate on the structure and properties of natural rubber/ carbon black composites, *Journal of polymers and the envirnment*, *27*(6), pp. 1367-1378.

244. Wolff S., Wang M.J., Tan E.H. (1993). Filler – elatomer interactions. Part VII. Study on bound rubber. *Rubber Chemistry and Technology*, *66*(2), pp.167-177.

245. Wren W.G. (1942). Application of the langmuir trough to the study of rubber latex. *Rubber Chemistry and Technology*,*15*(1): 107-114.

246. Wu, Y., MA, Y., Wang, Y., Zhang, L., (2004). Effect of characteristics of rubber, mixing and vulcanization on the structure and properties of rubber/ clay nanocomposites by melt melting, *Macromolecular Materials and Engineering*, *289*(10). pp. 890-894.

247. Wu Y.P., Wang Y.Q., Zhang H.F., Wang Y.Z., Yu D.S., Zhang L.Q & Yang, J. (2005). Rubber-pristine clay nanocomposites prepared by co-coagulating rubber latex and clay aqueous suspension. *Composites Science and Technology*, *65*(7), pp.1195–1202.

248. Wu J., Qu W., Huang G., Wang S., Liu H. (2017). Super-resolution fluorescence imageing of spatical organization of protein and lipids in natural rubber. *Biomacromolecules*,*18*(6): 1705-1712.

249. Wong, A., Wijannds S.F.L., Kubokit, T., Park C,B., (2013). Mechanisms of nanoclay-enhanced plastic forming processes: effects of nanoclay intercalation and exfoliation, *Journal of Nanoparticle Research*,*15*(8), pp. 1815.

250. Wongthong, P., Nakason, C., Pan, Q., Rempel., G.L., Kiatkamjornwong., (2013). Modification of deproteinized natural rubber via grafting polymerzation with maleic anhydride, *European Polymer Journal*, *49*, pp. 4035-4046.

251. Xu, Y., Guo, Z., Fang, Z., Peng, M., Shen, L., (2013) Combination of double-modified clay and polypropylene-graft maleic anhydride for the smultaneously improved thermal and mechanical properties of polypropylene, *Journal of Applied Polymer Science*, *128*(1), pp. 283-291.

252. Yahaya, L.E., Adebowale, K.O., Menon, A.R.R., (2009). Mechanical properties of organo modified Kaolin/natural rubber vulcanizates, *Applied Clay Science*, *46*(3), pp.283-288.

253. Yahaya, L.E., Adebowale, K.O., Menon, A.R.R., Rugmini, S., Olu-Owolabi, B.I., Chameswary, J., (2010). Natural rubber/ organoclay nanocomposites: Effect of filler dosage on the physico mechanical properties of vulcanizates, *African Journal of Pure and Applied Chemistry*, *4*(9), pp. 198-205.

254. Yanchan W., Zhang H., Longmei W., Jin L., Liao S., (2017). a review on characterization of molecular structure of natural rubber. *MOJ Polymer Science*, 1(6). pp.197-199.

255. Yangchuan, K., Chefen, L., Zongneng, Q., (1997). Crystallization properties and crystal and nanoscale morphology of PET-clay nanocomposite, *Journal of Applied Polymer Science*, *71*(7), pp. 1139-1146.

256. Yano, K., Usuki, A., Okada, A., Kurauchi, T., Kamigaito, O., (1993). Synthesis and properties of polyimide-clay hybrid. Journal of Polymer Science Part A: Polymer Chemistry, 31(10), pp. 2493-2498.

257. Yano, K., Usuki, A., Okada, A., (2000). Synthesis and properties of polyimide-clay hybrid films. *Journal of polymer science part A: Polymer Chemistry*, *35*(11), PP. 2289-2294.

258. Zhang, L., Wang, Y., Sui, Y., Yu, D., (2000). Morphology and mechanical properties of clay/ SBR nanocomposites, *Journal of Applied Polymer Science*, *78*(11), pp. 1873-1878.

259. Zhang, X., Loo, L.S., (2008). Morphology and mechanical properties of a novel amorphous polyamide/ nanoclay nanocomposite, *Journal of Polymer Science Part B Polymer Physics*, *46*(23), pp. 2605-2617.

260. Zhang, C., Wang, J., (2018). Natural rubber/ Dendrimer modified montmorillonite nanocomposites; mechanical and flame retardant properties, *Materials, 11*(1), pp. 1-17.

261. Zhong, J., Li, C., Li, S., Kong, L., Yang, L., Liao, S., She, X., (2009). Study on properties natural rubber during maturation, *Journal of Polymer Materials*, 26(3), pp. 351-360.

262. Zhou, W., Mark, J.E., Unroe, M.R., Arnold, F.E.J., (2001). Some clay nanocomposites based on a high-temperature, high-perfomance polymer, *Macromolecular Science Part A Pure and Applied Chemistry*, *38*(1), pp. 1-9.

263. Zilg, C., Thomann, R., Mulhaupt, R., Finter, J., (1999). Morphology and toughness/ stiffness balance of nanocomposites based upon anhydride-cured epoxy resin and layered silicates, *Macromolecule Chemistry and Physics*, *200*(3), pp. 661-670.