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FIG. 1

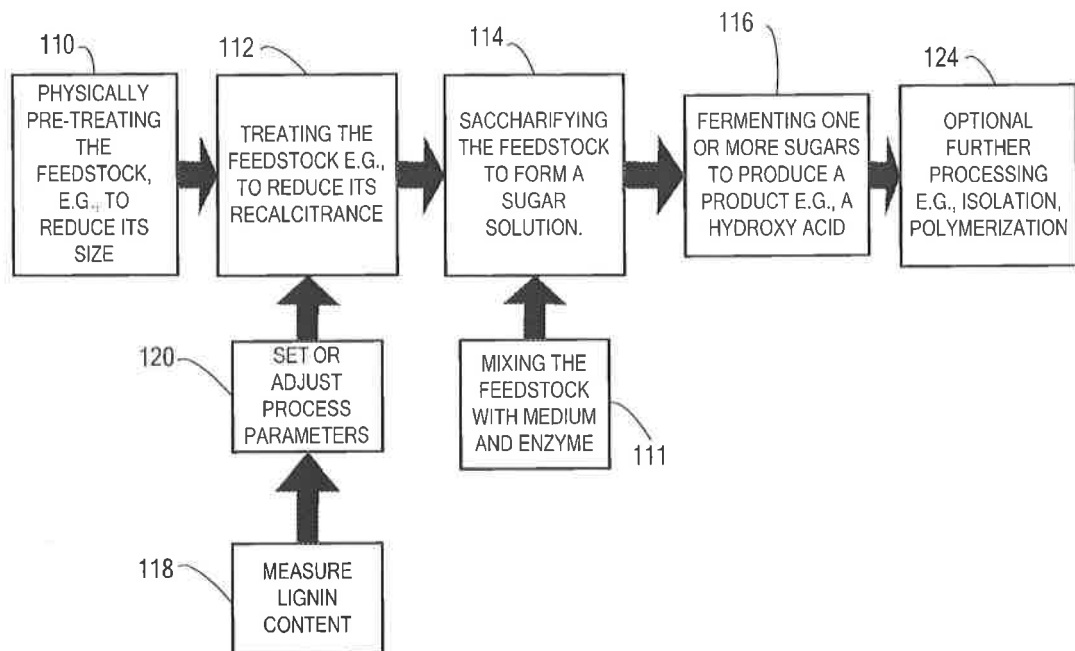


FIG. 2

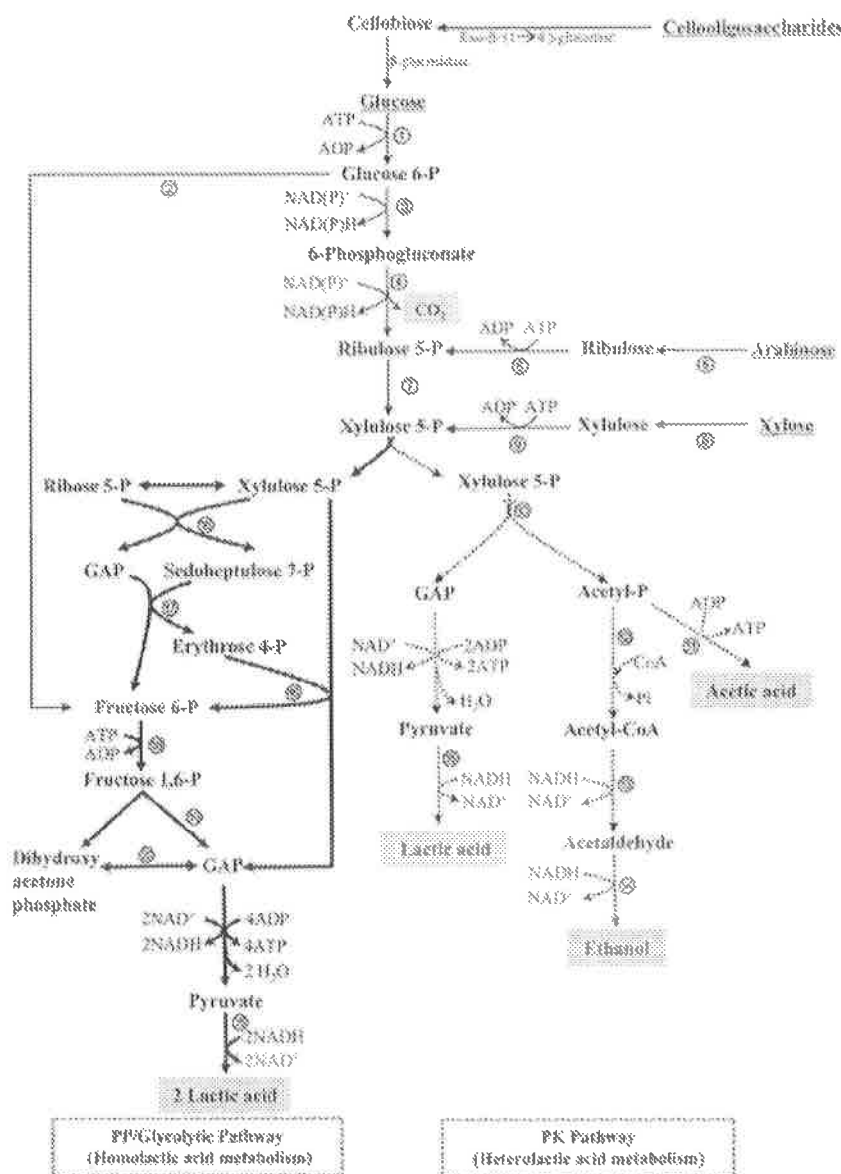
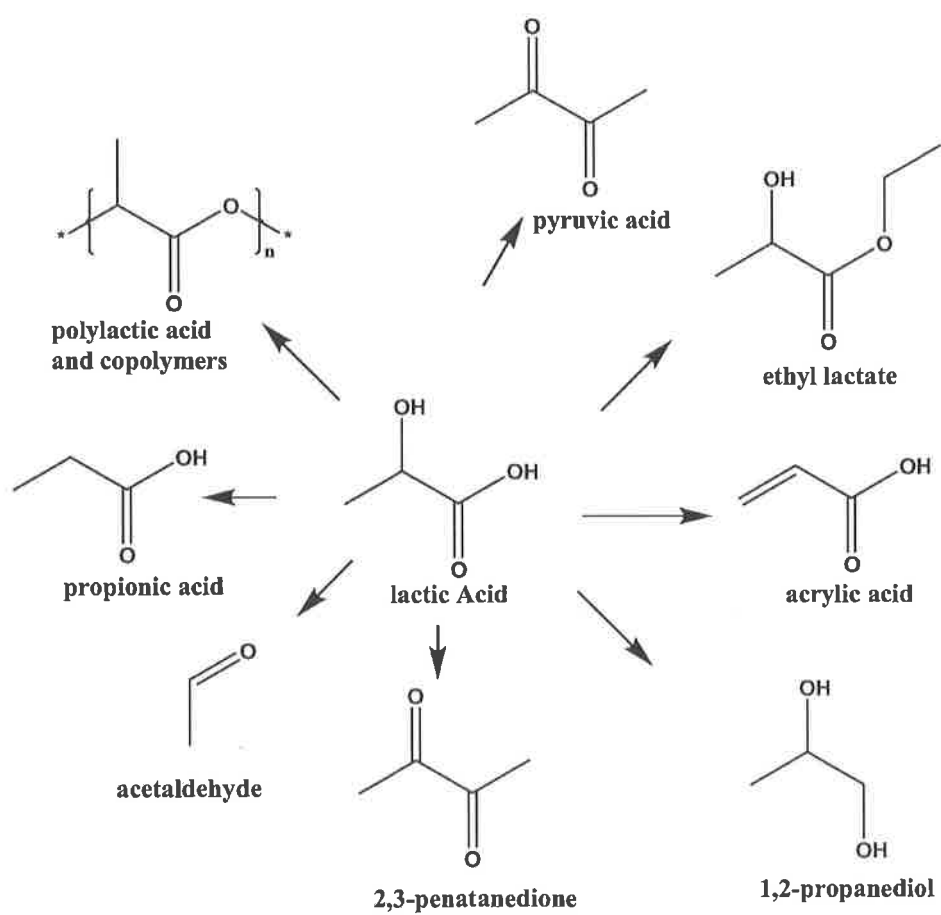


Fig. 2. Pathways for lactic acid production from lignocellulosidic disaccharides (glucose, xylose, and arabinose), by lactic acid bacteria. Enzymes: (1) hemiklase; (2) glucose 6-phosphate isomerase; (3) glucose 6-phosphate dehydrogenase; (4) 6-phosphogluconate dehydrogenase; (5) aldolase; fructose 6-phosphate; (6) ribulose 5-phosphate; (7) ribulose 5-phosphate isomerase; (8) glyceraldehyde 3-phosphate; (9) glyceraldehyde 3-phosphate dehydrogenase; (10) phosphoenolpyruvate; (11) pyruvate kinase; (12) phosphoenolpyruvate carboxylase; (13) dihydroxyacetone phosphate; (14) alcohol dehydrogenase; (15) lactate dehydrogenase; (16) transketolase; (17) transaldolase; (18) 6-phosphogluconate; (19) malate; (20) malate dehydrogenase; and (21) malate dehydrogenase. Solid lines indicate the nonenzymatic pathway. Thick solid lines and dashed lines indicate PP2C-dependent pathway and PP2C pathway, respectively.

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Fig. 3



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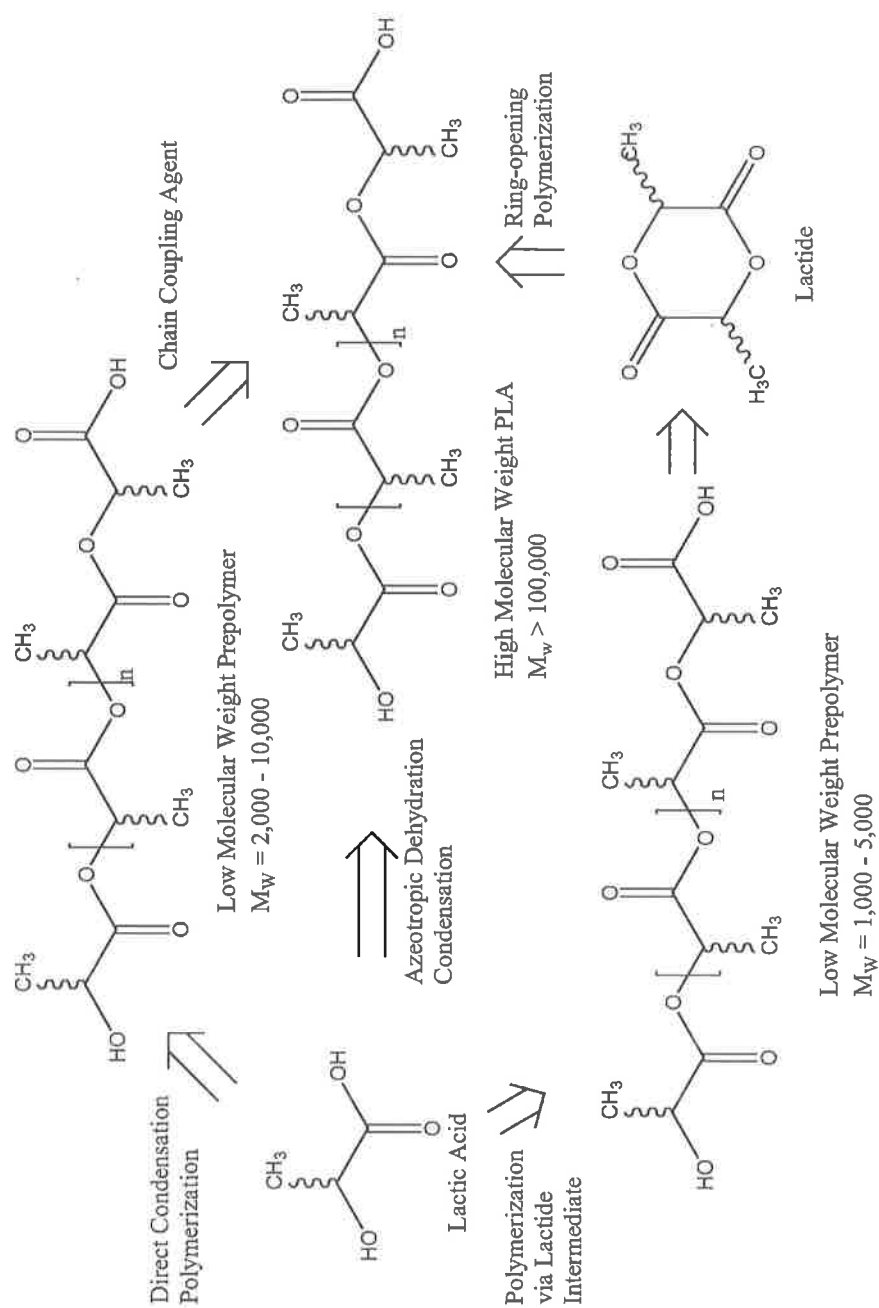


FIG. 4

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FIG. 5

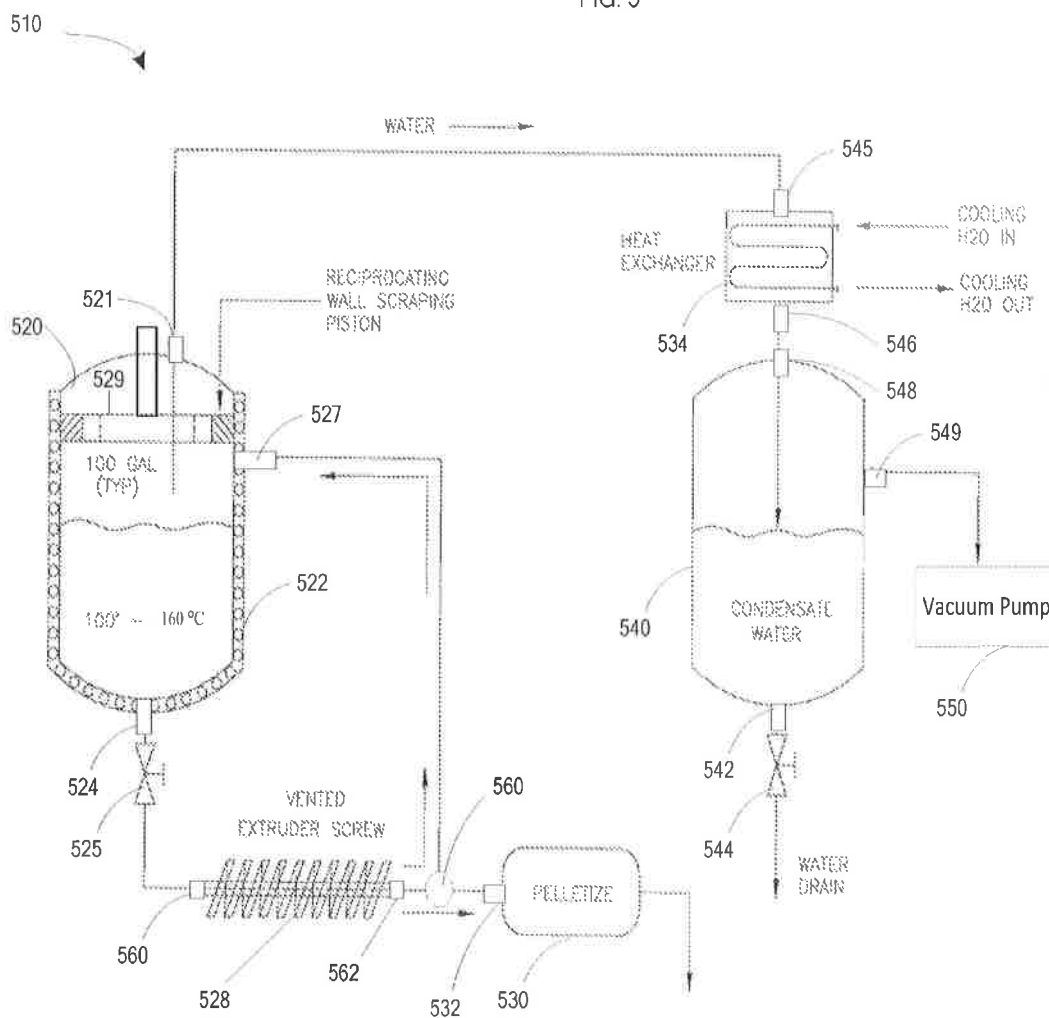


FIG. 6A

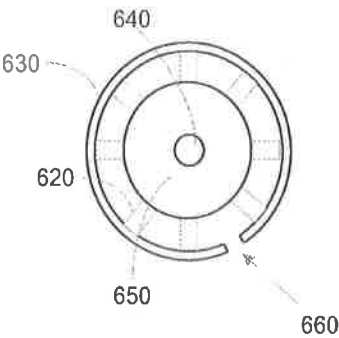


FIG. 6C

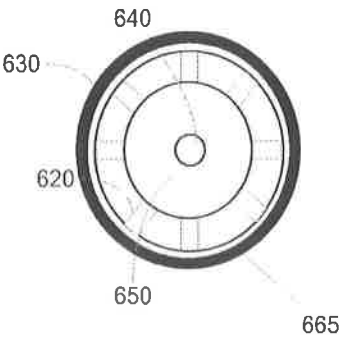


FIG. 6B

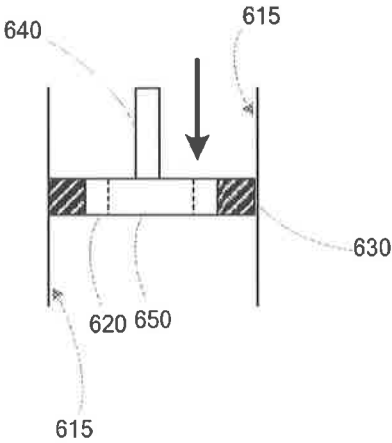
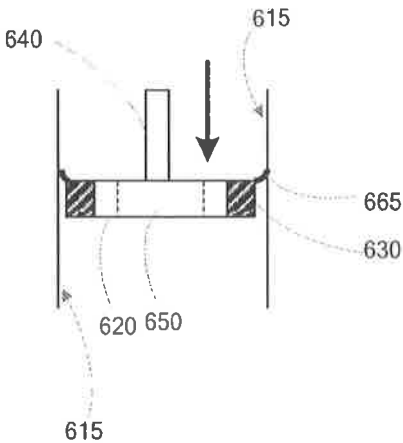


FIG. 6D



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FIG. 7

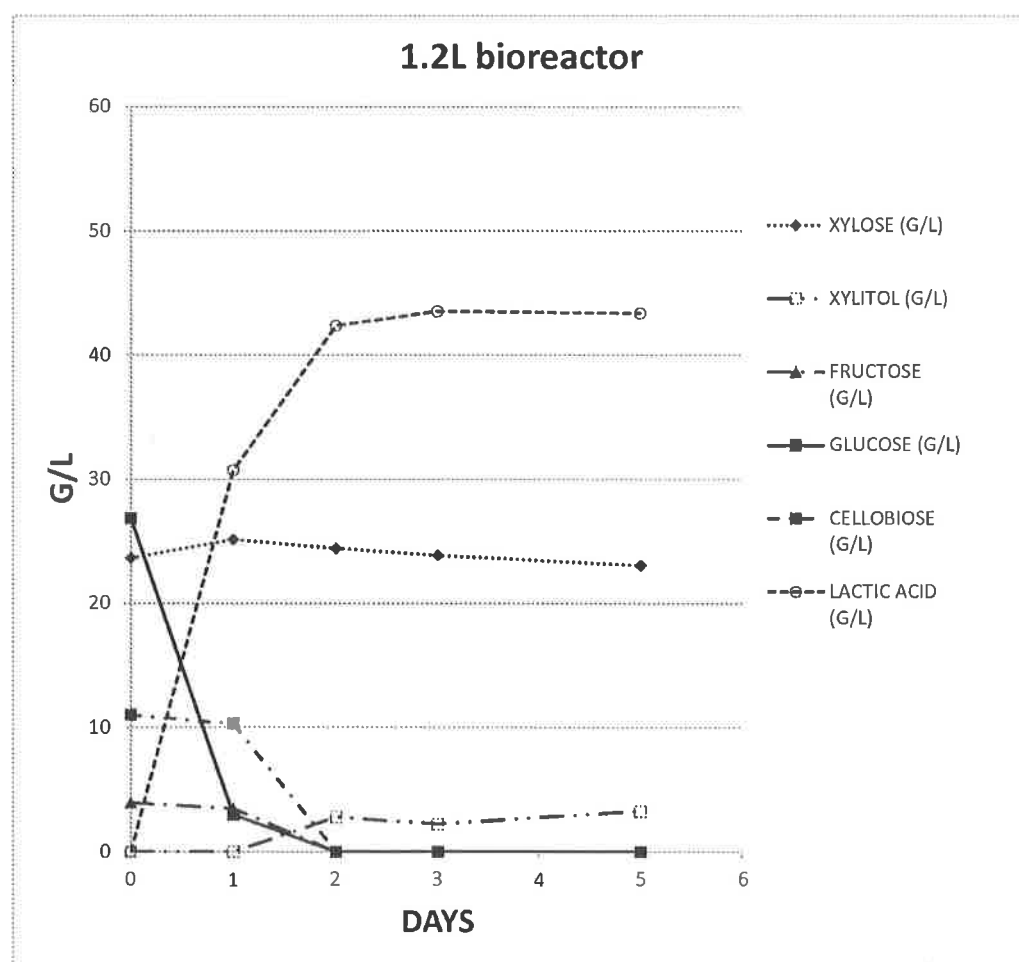
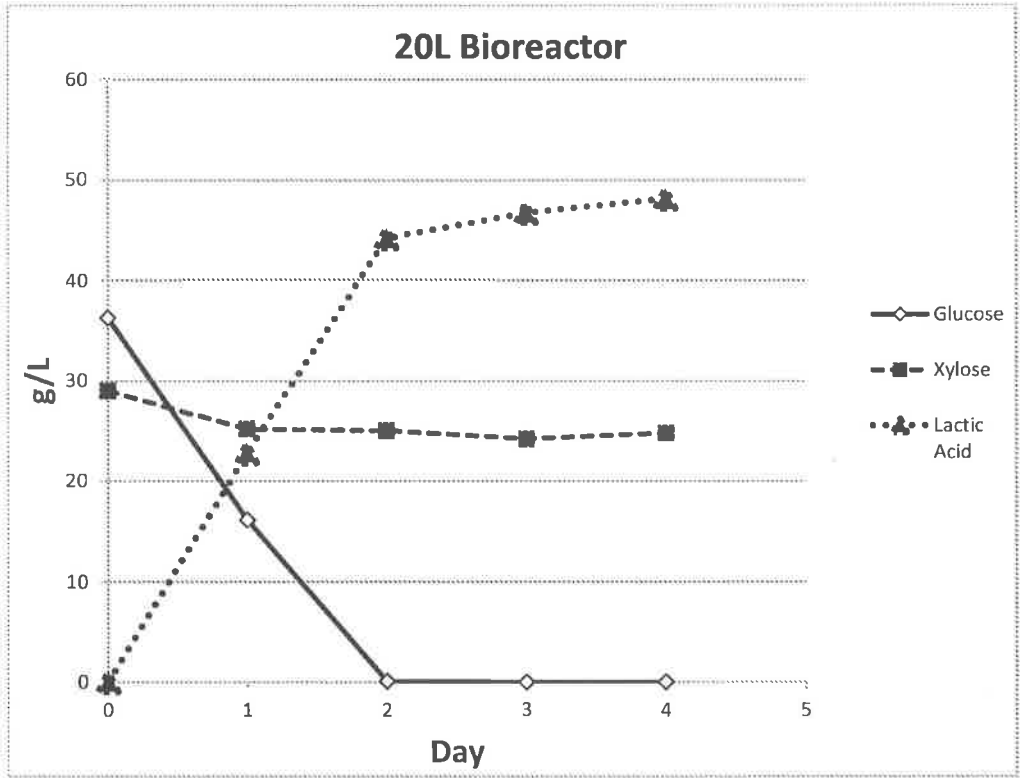
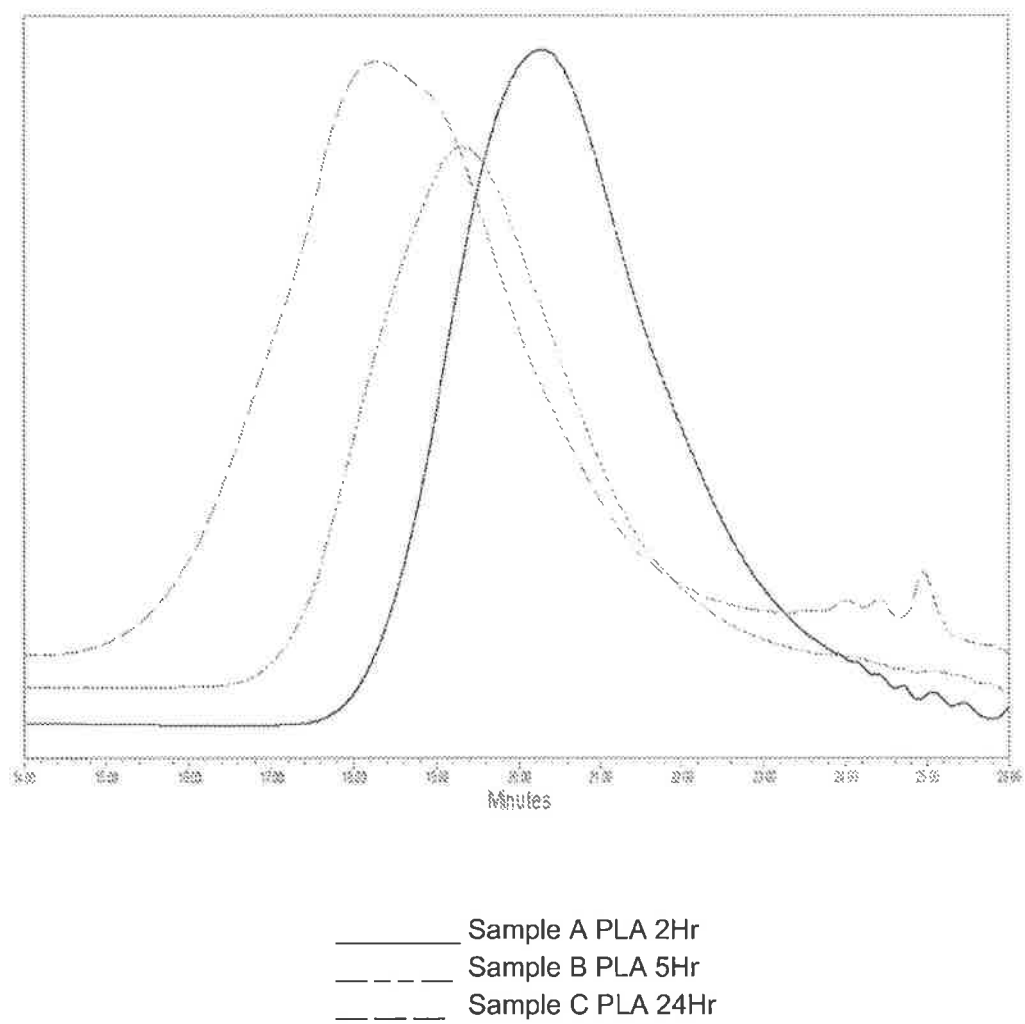


FIG. 8



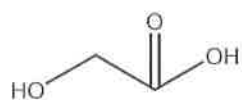
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FIG. 9

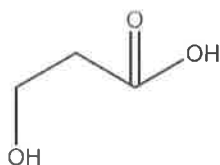


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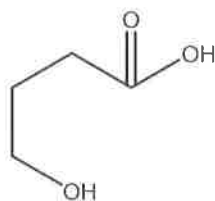
FIG. 10



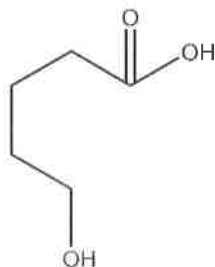
alpha-hydroxy carboxylic acid
(2-hydroxy acetic acid)



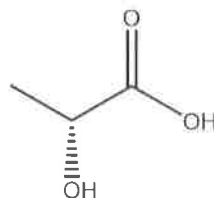
beta-hydroxy carboxylic acid
(3-hydroxy propionic acid)



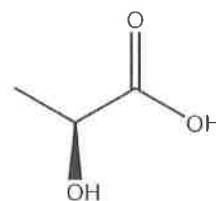
gamma-hydroxy carboxylic acid
(3 hydroxyl butyric acid)



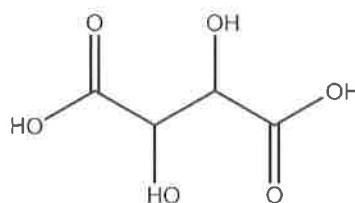
delta-hydroxy carboxylic acid
(4 hydroxy valeric acid)



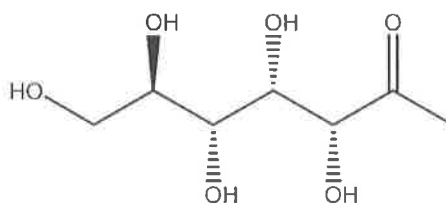
D-lactic acid



L-lactic acid



tartaric acid (alpha and beta; no
stereochemistry indicated)



gluconic acid
(alpha, beta, gamma and delta)