the PET monomer para-terepthalic acid (PTA) and FDCA allow for PEF polymerization using existing polyester infrastructure. In addition, PEF exhibits enhanced barrier, thermal, and mechanical properties when compared to PET.

[0005] FDCA can be produced from renewable sugars such as glucose and fructose. The conventional approaches to generate FDCA currently include two major competing routes: 1) oxidation and dehydration of fructose through an HMF intermediate, and 2) ketone formation at the C2 or C5 position of aldaric acids to promote furan formation.

SUMMARY

[0005a] In one aspect, provided herein is a chemoenzymatic process for the preparation of 2,5-furan dicarboxylic acid, the process comprising: contacting D-glucose with (i) at least two enzymes selected from the group consisting essentially of galactose oxidase, pyranose 2-oxidase, glucarate dehydratase, catalase, and a combination thereof to produce an intermediate; and (ii) contacting the intermediate with a metal catalyst and acid catalyst to form 2,5-furan dicarboxylic acid.

[0005b] In another aspect, provided herein is a chemoenzymatic process for the preparation of 2,5-furan dicarboxylic acid, the process comprising: enzymatic oxidation of 5-hydroxymethylfurfural using an enzymatic oxidizing composition comprising one or more enzymes selected from the group consisting of Aryl-alcohol oxidase (AAO) chloroperoxidase (CPO), 5-hydroxymethylfurfural oxidase (HMFO), glyoxal oxidase (GLOX), periplasmic aldehyde oxidase (PaoABC), unspecific peroxygenase (UPO), horseradish peroxidase (HRP), galactose oxidase (GAO) with and without the activating enzyme horseradish peroxidase (HRP), lactoperoxidase (LPO), myeloperoxidase (MPO), eosinophil peroxidase (EPO), thyroid peroxidase (TPO), ovoperoxidase, salivary peroxidase, vanadium haloperoxidase, non-mammalian vertebrate peroxidase (POX), peroxidasin (Pxd), bacterial peroxicin (Pxc), invertebrate peroxinectin (Pxt) and short peroxidockerin (PxDo), short peroxidockerin (Pxt), alpha-dioxygenase (aDox), dual oxidase (DuOx), prostaglandin H synthase or cyclooxygenase (PGHS/CyOx), linoleate diol synthase (LDS), functional variants thereof, and any combination thereof to form an intermediate; and oxidizing the intermediate using a metal catalyst to form 2,5-furan dicarboxylic acid.

[0006] Disclosed herein is a chemoenzymatic process for the preparation of 2,5-furan dicarboxylic acid, the process comprising contacting D-glucose with (i) at least two enzymes selected from the group consisting essentially of galactose oxidase, pyranose 2-oxidase, glucarate dehydratase, catalase, and a combination thereof to produce an intermediate; and (ii) contacting the intermediate with a metal catalyst and acid catalyst to form 2,5-furan dicarboxylic acid.

[0007] Also disclosed herein is a chemoenzymatic process for the preparation of 2,5-furan dicarboxylic acid, the process comprising enzymatic oxidation of 5-hydroxymethylfurfural using an enzymatic oxidizing composition comprising one or more enzymes selected from the group consisting of Aryl-alcohol oxidase (AAO) chloroperoxidase (CPO), 5-hydroxymethylfurfural oxidase (HMFO), glyoxal oxidase (GLOX), periplasmic aldehyde oxidase (PaoABC), unspecific peroxygenase (UPO), horseradish peroxidase (HRP), galactose oxidase (GAO) with and without the activating enzyme horseradish peroxidase (HRP), lactoperoxidase (LPO), myeloperoxidase (MPO), eosinophil peroxidase (EPO), thyroid peroxidase (TPO), ovoperoxidase, salivary peroxidase, vanadium haloperoxidase, non-mammalian vertebrate peroxidase (POX), peroxidasin (Pxd), bacterial peroxicin (Pxc), invertebrate peroxinectin (Pxt) and short peroxidockerin (PxDo), short peroxidockerin (Pxt), alpha-dioxygenase (aDox), dual oxidase (DuOx), prostaglandin H synthase or cyclooxygenase (PGHS/CyOx), linoleate diol synthase (LDS), functional variants thereof, and any combination thereof to form an intermediate; and oxidizing the intermediate using a metal catalyst to form 2,5-furan dicarboxylic acid.