## Claims

**What is claimed is:**

1. An isolated DNA coding for a recombinant β-hexosyl-transferase (rBHT) protein having the amino acid sequence set forth in SEQ ID NO. 4, 6, 8, 10, 12, 14, 16, 18 or 20, or a variant thereof having an amino acid substitution, wherein the amino acid substitution is a conservative substitution wherein one amino acid within a group is exchanged for another amino acid within the same group, where the groups are the following: (1) alanine, valine, leucine, isoleucine, methionine, norleucine, and phenylalanine; (2) histidine, arginine, lysine, glutamine, and asparagine; (3) aspartate and glutamate; (4) serine, threonine, alanine, tyrosine, phenylalanine, tryptophan, and cysteine; and (5) glycine, proline, and alanine, preferably having the amino acid sequence set forth in SEQ ID NO. 12 or 14.

2. The isolated DNA coding for the recombinant β-hexosyl-transferase (rBHT) protein of claim 1, wherein the DNA has at least 97% identity with the nucleic acid sequence set forth in SEQ ID NO. 3, 5, 7, 9, 11, 13, 15, 17 or 19, preferably having the nucleic acid sequence set forth in SEQ ID NO. as set forth in SEQ ID NO. 13 or 15.

3. An enzymatically active recombinant β-hexosyl-transferase (rBHT) protein wherein the protein has the amino acid sequence set forth in SEQ ID NO. 4, 6, 8, 10, 12, 14, 16, 18 or 20, or a variant thereof having an amino acid substitution, wherein the amino acid substitution is a conservative substitution wherein one amino acid within a group is exchanged for another amino acid within the same group, where the groups are the following: (1) alanine, valine, leucine, isoleucine, methionine, norleucine, and phenylalanine; (2) histidine, arginine, lysine, glutamine, and asparagine; (3) aspartate and glutamate; (4) serine, threonine, alanine, tyrosine, phenylalanine, tryptophan, and cysteine; and (5) glycine, proline, and alanine.

4. The enzymatically active rBHT protein of claim 3, wherein the protein is membrane bound or a soluble enzyme.

5. A method for producing enzymatically active recombinant β-hexosyl-transferase (rBHT) protein in a eukaryotic host cell which comprises transforming the eukaryotic host cell with a plasmid under the control of a suitable promotor wherein the plasmid contains an

isolated DNA coding for a rBHT protein having the amino acid sequence set forth in SEQ ID NO. 4, 6, 8, 10, 12, 14, 16, 18 or 20, or a variant thereof having an amino acid substitution, wherein the amino acid substitution is a conservative substitution wherein one amino acid within a group is exchanged for another amino acid within the same group, where the groups are the following: (1) alanine, valine, leucine, isoleucine, methionine, norleucine, and phenylalanine; (2) histidine, arginine, lysine, glutamine, and asparagine; (3) aspartate and glutamate; (4) serine, threonine, alanine, tyrosine, phenylalanine, tryptophan, and cysteine; and (5) glycine, proline, and alanine.

6. The method of claim 5, wherein the isolated DNA codes for the rBHT protein having the amino acid sequence set forth in SEQ ID NO. 18 and is linked to a DNA coding for a signal peptide, preferably an *S. cerevisiae* α-factor signal peptide.

7. The method of claim 5, wherein the suitable promotor is an alcohol oxidase promotor.

8. The method of claim 5, wherein the enzymatically active rBHT protein has a specific activity of about 8 $U.mg^{-1}$ at $20^{o}C$.

9. The method of claim 5, wherein the eukaryotic host cell is a yeast cell, preferably a *Pichia pastoris* yeast cell.

10. A method for producing galacto-oligosaccharides (GOS) which comprises reacting lactose with an enzymatically active recombinant β-hexosyl-transferase (rBHT) protein having the amino acid sequence set forth in SEQ ID NO. 4, 6, 8, 10, 12, 14, 16, 18 or 20 or a variant thereof thereof having an amino acid substitution, wherein the amino acid substitution is a conservative substitution wherein one amino acid within a group is exchanged for another amino acid within the same group, where the groups are the following: (1) alanine, valine, leucine, isoleucine, methionine, norleucine, and phenylalanine; (2) histidine, arginine, lysine, glutamine, and asparagine; (3) aspartate and glutamate; (4) serine, threonine, alanine, tyrosine, phenylalanine, tryptophan, and cysteine; and (5) glycine, proline, and under suitable conditions so as to produce GOS.

11. The method of claim 10, wherein the enzymatically active rBHT protein is immobilized on a solid support.

12. The method of claim 10, wherein the GOS is produced in a batch or continuous stirred-tank reactor, a packed-bed reactor, or an ultrafiltration membrane reactor.

13. The method of claim 10, further comprising a generally recognized as safe (GRAS) organism as a glucose removal system to avoid competitive glucose inhibition, preferably the glucose removal system is used simultaneously with the enzymatically active rBHT protein.

14. A modified lactose-containing foodstuff or food byproduct comprising a recombinant β-hexosyl-transferase (rBHT) protein having the amino acid sequence set forth in SEQ ID NO. 4, 6, 8, 10, 12, 14, 16, 18 or 20 or a variant thereof having an amino acid substitution, wherein the amino acid substitution is a conservative substitution wherein one amino acid within a group is exchanged for another amino acid within the same group, where the groups are the following: (1) alanine, valine, leucine, isoleucine, methionine, norleucine, and phenylalanine; (2) histidine, arginine, lysine, glutamine, and asparagine; (3) aspartate and glutamate; (4) serine, threonine, alanine, tyrosine, phenylalanine, tryptophan, and cysteine; and (5) glycine, proline, and alanine, preferably the foodstuff is a dairy product or byproduct.

15. The lactose-containing foodstuff or food byproduct of claim 14, wherein the foodstuff or food byproduct is a baby dessert, a baby juice, a baby snack, a baby yoghurt drink, an energy drink, a fitness water or thirst quencher, a frozen dairy dessert, a fruit drink (vitamin/mineral fortified), a fruit pie filling, a fruit preparation, an infant formula, an infant meal replacement drink, a jelly jam, a meal replacement drink, a milk, a milk-based drink, a milk substitute, a syrup flavoring for milk, a yoghurt, or a whey.