These and other objects, advantages and features of the present invention will become apparent from the following specification taken in conjunction with the claims set forth herein.

BRIEF SUMMARY ~~OF THE INVENTION~~

Methods for stabilizing use solutions for detergent warewashing and stabilizing enzymes in detergent and multi-use compositions, in particular high temperature detergent applications to prolong enzyme stability and cleaning performance, are provided according to the ~~invention~~present disclosure. An advantage of the ~~invention~~ present disclosure is the prolonged stability of enzymes, namely protease enzymes, and prolonged stability of use solutions of cleaning compositions at high temperatures for various detergent applications in comparison to compositions and use solutions of compositions that do not include the stabilizing agents disclosed herein.

In an aspect, there is provided a multi-use solid detergent composition comprising: an alkali metal carbonate alkalinity source; a protease enzyme; a nitrogen-containing or a soluble starch or polysaccharide stabilizing agent; and water; wherein said detergent has an alkaline pH of at least about 9; and wherein a detergent use solution of the composition maintains cleaning performance at temperatures of at least about 65°C in use solution for at least about 20 minutes. In an embodiment, the present ~~invention~~ disclosure includes detergent use solutions for removing soils, including protein soils, from a surface of a substrate and preventing redeposition of protein soils onto the surface of the substrate. The detergent use solutions beneficially reduce and/or prevent foaming in the cleaning application providing further benefits of use. The use solutions according to embodiments of the ~~invention~~ present disclosure include an alkali metal carbonate alkalinity source, protease enzymes and a stabilizing agent, such as for example an amine such as a casein or gelatin (nitrogen-containing stabilizer) or a poly sugar (starch-based stabilizer).

In another aspect, there is provided a stabilized multi-use detergent use solution composition produced by the process comprising: providing a detergent use composition comprising: an alkali metal carbonate alkalinity source; a protease enzyme; either an amine, amide, polyamide and/or polyamine stabilizing agent or a polysaccharide stabilizing agent; and water, wherein said detergent use composition is provided in one or more solid

and/or liquid compositions to generate said use composition; contacting the solid detergent composition with a diluent to generate an aqueous use solution; wherein said use solution has an alkaline pH of at least about 9; wherein said protease retains enzymatic activity in said use solution for at least 20 minutes at temperatures between about 65-80°C. In yet another aspect, there is provided a method of cleaning using a stabilized multi-use detergent composition comprising: generating a use solution of a detergent composition comprising an alkali metal carbonate alkalinity source, a protease enzyme, either a nitrogen-containing stabilizing agent or a soluble starch or polysaccharide stabilizing agent, and water, wherein said detergent composition is provided in one or more solid and/or liquid compositions; contacting a surface with said use solution; andcleaning said surface with said use solution, wherein said use solution has an alkaline pH of at least about 9, and wherein said protease retains enzymatic activity in said use solution for at least 20 minutes at temperatures between about 65-80°C. In a further embodiment, the present ~~invention~~ disclosure includes methods of stabilizing multi-use detergent use solutions and employing the same for removing soils, including protein soils, from a surface of a substrate and preventing redeposition of protein soils onto the surface of the substrate. The methods include generating and introducing a stabilized, enzyme-containing detergent use solution during a washing step of a wash cycle, washing the surface of the substrate with the use solution during the wash cycle, and subsequently rinsing the surface of the substrate (with or without a rinse aid). The generating of the use solution and wash cycle according to the ~~invention~~ present disclosure for cleaning a substrate is suitable for use at high temperatures and pH over extended periods of time, including for example at

temperatures in excess of about 65°C at pH in excess of about 9 for periods of time of at least 20 minutes, or at least 30 minutes, or still more preferably at least 40 minutes.

The enzyme-containing multi-use detergent use solutions according to embodiments of the ~~invention~~ present disclosure can be obtained by contacting an enzyme-containing detergent composition with water and/or adding an enzyme source to a detergent use solution. For example, according to embodiments of the present disclosure~~invention~~, the aqueous use solutions can be obtained by contacting a detergent composition and an enzyme composition with a water source, by contacting a combination detergent/enzyme composition with a water source, and/or providing an enzyme source directly to an aqueous use solution of a detergent composition. Accordingly, the detergent composition and enzyme composition (or enzyme source) may be formulated in combination or separately according to use in the methods of the present disclosure~~invention~~. The active level of the aqueous use solution is adjusted to a desired level through control of variables such as the amount of active enzymes in the detergent and enzyme compositions, length of time and the temperature at which the water contacts the detergent and enzyme compositions, and the like.

The particular enzyme or combination of enzymes for use according to embodiments of the present disclosure ~~invention~~ can vary according to factors including for example, applications of use for the stabilized use solutions, physical product form, use pH, use temperature, and soil types to be cleaned. According to the present disclosure~~invention~~, the enzyme(s) are selected to provide optimum activity and stability for a given set of utility conditions as one skilled in the art will recognize based on the disclosure of the claimed invention. In a preferred ~~aspect~~embodiment, protease enzymes are particularly suitable for use under high temperature detergent applications.

While multiple embodiments are disclosed, still other embodiments of the present ~~invention~~ disclosure will become apparent to those skilled in the art from the following detailed description, which shows and describes illustrative embodiments of the ~~invention~~disclosure. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not restrictive.