

ABSTRACT OF THE DISCLOSURE

A high temperature-stable and highly purified cross-linked (optionally $\geq 70\%$ β - β linked) tetrameric hemoglobin with high efficiency of oxygen delivery suitable for use in mammals without causing renal injury and vasoconstriction is provided. The dimeric form of hemoglobin is degenerated and purification processes are performed on red blood cells from whole blood. Controlled hypotonic lysis in an instant cytolysis apparatus prevents lysis of white blood cells. Nucleic acids from white blood cells and phospholipids impurities are not detected. Blocking of reactive sulfhydryl groups by a sulfhydryl reagent is performed in an oxygenated environment. Flowthrough column chromatography removes different plasma protein impurities. N-acetyl cysteine is added to the cross-linked tetrameric hemoglobin to maintain a low level of met-hemoglobin. The stabilized hemoglobin is preserved in an infusion bag with aluminum overwrap to prevent formation of inactive met-hemoglobin from oxygen intrusion. The product finds use in tissue oxygenation and cancer treatment.