group, a substituted or unsubstituted heterocyclic group and a halogen atom and $P(O)(R_{13})_2$, $S(O)R_{13}$, $S(O_2)R_{13}$ and $C(O)R_{13}$, wherein R_{13} is a halogen atom.

26. The method of producing cross-linked stroma-free hemoglobin as claimed in claim **20**, wherein the group other than a leaving group represented by R_6, R_7, R_8 and R_9 is selected from the group consisting of a hydrogen atom, a C_1–C_{12} alkyl group, an aryl group, and a heterocyclic group.

27. The method of producing cross-linked stroma-free hemoglobin as claimed in claim **26**, wherein R_6, R_7, R_8 and R_9 are selected from the group consisting of C_2H_5, a phenyl group, or an imidazolyl group.

28. The method of producing cross-linked stroma-free hemoglobin as claimed in claim **20**, wherein the leaving group represented by R_1, R_2, R_3, R_4, R_6, R_7, R_8 and R_9 is selected from the group consisting of a halogen atom and OR_{11}, wherein R_{11} is selected from the group consisting of a hydrogen atom, a substituted or unsubstituted C_1–C_{12} alkyl group, a substituted or unsubstituted mono- or bicyclic aryl group and a substituted or unsubstituted heterocyclic group.

29. The method of producing cross-linked stroma-free hemoglobin as claimed in claim **28**, wherein R_{11} is selected from the group consisting of CH_3, C_2H_5, $CH_2C_6H_5$, and C_6H_5.

30. The method of producing cross-linked stroma-free hemoglobin as claimed in claim **20**, wherein X is selected from the group consisting of SO_2, SO, $P(O)(OR_{11})$, CO, Se, Te and Sr, wherein R_{11} is selected from the group consisting of a hydrogen atom, a substituted or unsubstituted C_1–C_{12} alkyl group, a substituted or unsubstituted mono- or bicyclic aryl group and a substituted or unsubstituted heterocyclic group.

31. The method of producing cross-linked stroma-free hemoglobin as claimed in claim **30**, wherein X is selected from the group consisting of SO_2, SO, $P(O)(OR_{11})$ and CO, wherein R_{11} is as defined above.

32. The method of producing cross-linked stroma-free hemoglobin as claimed in claim **20**, wherein $n=0$ to 2, $n=0$ to 2, and $l=0$ to 2.

33. The method of producing cross-linked stroma-free hemoglobin as claimed in claim **20**, wherein said reagent is selected from the group consisting of ethyl-2,2′-sulfonyl-bis-cyanoacetate, diethyl-2,2′-sulfonyl-bis-malonate, ethyl-2,2′-sulfonyl-2,2′-benzene sulfonyl-bis-acetate, 2,2′-sulfonyl-2,2′-imidazole-N-sulfonyl-bis-acetonitrile, methyl 2,2′-sulfonyl-bis-cyanoacetate, 2,2′-methoxymethylene-2,2′-sulfonyl-bis-acetonitrile and dimethyl 2,2′-methoxyphosphinylidene-2-2′-methoxymethylene-bis-methanephosphonate.

34. The method of producing cross-linked stroma-free hemoglobin as claimed in claim **20**, wherein said stroma-free hemoglobin is selected from the group consisting of human, equine, porcine, ovine, bovine, simian and fish hemoglobin.

35. The method of producing cross-linked stroma-free hemoglobin as claimed in claim **20**, wherein said stroma-free hemoglobin is bovine hemoglobin.

36. The method of producing cross-linked stroma-free hemoglobin as claimed in claim **20**, wherein said stroma-free hemoglobin is human hemoglobin.

37. The method of producing cross-linked stroma-free hemoglobin as claimed in claim **20**, wherein said cross-linking is carried out in the presence of oxygen.

38. The method of producing cross-linked stroma-free hemoglobin as claimed in claim **20**, wherein said cross-linking is carried out in the absence of oxygen.

39. The method of producing cross-linked hemoglobin as claimed in claim **20**, wherein said cross-linking is carried out at about 10° C. to 37° C.

40. The method of producing cross-linked hemoglobin as claimed in claim **39** wherein said cross-linking is carried out at about 25° C. to 30° C.

41. The method of producing cross-linked hemoglobin as claimed in claim **20**, wherein the molar ratio of said reagent to said hemoglobin is 1:1 to 1:10.

42. The method of producing cross-linked hemoglobin as claimed in claim **41**, wherein the molar ratio of said reagent to said hemoglobin is 1:2 to 1:6.

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