WHAT IS CLAIMED IS:

1. A process for preparing cyclohexanol and cyclohexanone by cyclohexane oxidation, comprising steps of: non-catalyticly oxidizing cyclohexane with molecular oxygen in the air to obtain an oxidation mixture containing cyclohexyl hydroperoxide (CHHP) as a main product; performing a homogenous catalytic decomposition of the CHHP to obtain cyclohexanol and cyclohexanone; and rectifying to obtain products of the cyclohexanol and the cyclohexanone;

wherein the step of performing the homogenous catalytic decomposition of the CHHP comprises using a homogeneous catalytic decomposition reaction and distillation vessel which removes water via azeotropic rectification to reduce a water content of a decomposition liquid to be below 100ppm;~~.~~

~~2.The process, as recited in claim 1,~~ wherein the homogeneous catalytic decomposition reaction and distillation vessel comprises a decomposition reaction and distillation vessel having 3~5 decomposition reaction chambers; a tubular heater bundle with steam serving as a heating medium is provided in the decomposition reaction and distillation vessel; a dehydration and rectification column is connected to the decomposition reaction and distillation vessel; the step of performing the homogenous catalytic decomposition of the CHHP comprises steps of:

heating decomposition reaction liquid by the tubular heater bundle to evaporate the cyclohexane in the decomposition liquid;

controlling a flow of the steam as the heating medium to evaporate 20~40 wt% of the cyclohexane in the decomposition liquid in the decomposition reaction and distillation vessel;

entering, by the evaporated cyclohexane, the dehydration and rectification column to be further dehydrated and purified, and then entering, by the evaporated

cyclohexane, a condenser at a top of the dehydration and rectification column to be cooled;

next, refluxing a part of the cyclohexane in a liquid phase at a reflux ratio of 0.3~0.5, and returning the rest cyclohexane to an oxidation reactor after rinsing with water, wherein a content of cyclohexanol and cyclohexanone in the part of the cyclohexane is lower than 0.04% by controlling the reflux;

to a first chamber of the decomposition reaction and distillation vessel continuously adding an oil-soluble transitional metal catalyst whose amount is determined to ensure that a content of transitional metal ions in cyclohexane oxidation liquid is 12±10ppm; and

to a second chamber of the decomposition reaction and distillation vessel continuously adding oil-soluble 1-hydroxy ethidene-1,1-diphosphonic acid (di)octyl ester which serves as a scale inhibitor, wherein a weight ratio of the added scale inhibitor and the transitional metal ions of the catalyst is 1:0.8~1.2;

wherein during the step of performing the homogenous catalytic decomposition of the CHHP, a decomposition temperature is controlled at 80°C~160°C, and a pressure is controlled at 0~1MPa, wherein the pressure is a gauge pressure.

~~3.~~2. The process, as recited in claim ~~2~~1, wherein the oil-soluble transitional metal catalyst is one member selected from a group consisting of bis(tert-butyl) chromate, cobalt naphthenate and cobalt octoate; the amount of the added catalyst is determined to ensure that the content of the transitional metal ions in the cyclohexane oxidation liquid is 12±8ppm.

~~4.~~3. The process, as recited in claim ~~3~~2, wherein during the step of performing the homogenous catalytic decomposition of the CHHP, the decomposition temperature is controlled at 90±2°C, and the pressure is controlled at 0.03±0.01MPa, wherein the pressure is the gauge pressure.

~~5.~~4. The process, as recited in claim ~~2~~1, ~~3~~ 2 or ~~or~~ 43, wherein during the step of performing the homogenous catalytic decomposition of the CHHP, the weight ratio of the added oil-soluble 1-hydroxy ethidene-1,1-diphosphonic acid (di)octyl ester and the transitional metal ions of the catalyst is 1:1.

~~6.~~5. The process, as recited in claim 1, 2 or 3,~~2, 3 or 4~~, wherein a reactor residence time of an oxidation mixture liquid containing CHHP in each decomposition reaction chamber of the decomposition reaction and distillation vessel is at a range of 5~8 minutes, totaling 20~40 minutes.

~~7.~~6. The process, as recited in claim 1, wherein during the step of performing the homogenous catalytic decomposition of the CHHP, the flow of the steam which serves as the heating medium is controlled to evaporate 30±5% of the cyclohexane in the reaction and distillation vessel.

~~8.~~7. A device of the process for preparing cyclohexanol and cyclohexanone by cyclohexane oxidation as recited in claim 1, comprising the homogeneous catalytic decomposition reaction and distillation vessel which is a decomposition reaction and distillation vessel having 3~5 decomposition reaction chambers provided therein, wherein each the decomposition reaction chamber has a tubular heater bundle; and a separating board with a through-hole is provided between each two the decomposition reaction chambers.