CLAIMS

~~1. A catalyst comprising molybdenum, bismuth, and iron, wherein R1 represented by the following equation (1) is 0.45 or more and 5.00 or less,~~

~~R1 = (maximum value of peak at 886 cm^{-1} ± 5 cm^{-1}) ÷ (maximum value of peak at 354 cm^{-1} ± 5 cm^{-1}) as measured by Raman spectroscopy (1).~~

1~~2~~. A catalyst comprising molybdenum, bismuth, and iron, wherein R2 represented by the following equation (2) is 951.4 cm^{-1} or more and 959.0 cm^{-1} or less,

R2 = wave number (cm^{-1}) for giving maximum value of maximum peak at 952 cm^{-1} ± 7 cm^{-1} as measured by Raman spectroscopy (2).

2~~3~~. A catalyst comprising molybdenum, bismuth, and iron, wherein R3 represented by the following equation (3) is 0.21 or more,

R1 = (maximum value of peak at 886 cm^{-1} ± 5 cm^{-1}) ÷ (maximum value of peak at 354 cm^{-1} ± 5 cm^{-1}) as measured by Raman spectroscopy (1),

R2 = wave number (cm^{-1}) for giving maximum value of maximum peak at 952 cm^{-1} ± 7 cm^{-1} as measured by Raman spectroscopy (2),

$$R3 = 2.95 \times R1 + 0.33 \times R2 - 315 \quad (3).$$

3. The catalyst according to claim 1 or 2, wherein R1 represented by the following equation (1) is 0.45 or more and 5.00 or less,

R1 = (maximum value of peak at 886 cm^{-1} ± 5 cm^{-1}) ÷ (maximum value of peak at 354 cm^{-1} ± 5 cm^{-1}) as measured by Raman spectroscopy (1).

4. The catalyst according to any one of claims 1 to 3, wherein a composition of a catalytically active component is represented by the following formula (I),

$$Mo_{a1}Bi_{b1}Ni_{c1}Co_{d1}Fe_{e1}X_{f1}Y_{g1}Z_{h1}O_{i1} \quad (I)$$

where, Mo, Bi, Ni, Co, and Fe respectively represent molybdenum, bismuth, nickel, cobalt, and iron; X is at least one element selected from tungsten, antimony, tin, zinc, chromium, manganese, magnesium, silicon, aluminum, cerium, and titanium; Y is at least one element selected from sodium, potassium, cesium, rubidium, and thallium; Z belongs to

Groups 1 to 16 in the periodic table, and means at least one element selected from elements other than the above Mo, Bi, Ni, Co, Fe, X, and Y; a1, b1, c1, d1, e1, f1, g1, h1, and i1 respectively represent the number of atoms of molybdenum, bismuth, nickel, cobalt, iron, X, Y, Z, and oxygen; and when a1 = 12, $0 < b1 \leq 7$, $0 \leq c1 \leq 10$, $0 < d1 \leq 10$, $0 < c1+d1 \leq 20$, $0 \leq e1 \leq 5$, $0 \leq f1 \leq 2$, $0 \leq g1 \leq 3$, $0 \leq h1 \leq 5$, and i1 is a value determined by an oxidation state of each element.

5. The catalyst according to any one of claims 1 to 4, wherein the catalytically active component is carried on an inert carrier.

6. The catalyst according to claim 5, wherein the inert carrier is silica, alumina, or a combination thereof.

7. A method for producing the catalyst according to any one of claims 1 to 6, comprising:

a blending step of adding each source compound containing molybdenum, bismuth and iron to a solvent or solution and performing integration and heating to form a blended solution, wherein, in the blending step, pH of the blended solution is adjusted to a range of 1.0 to 7.5 before adding an iron raw material.

8. A method for producing an unsaturated aldehyde and/or an unsaturated carboxylic acid using the catalyst according to any one of claims 1 to 6.