Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Supporting information

Quantification of formaldehyde

The formaldehyde concentration was quantified using a Nash reagent composed of acetylacetone and acetic acid/ammonium acetate buffer.[1-6] Formaldehyde is reacted with an ammonium acetate and acetylacetone under neutral conditions to produce 3,5-diacetyl-1,4-dihydrolutidine as shown in Figure S1. 3,5-Diacetyl-1,4-dihydrolutidine is a yellow compound with maximum absorbance at 410 nm.

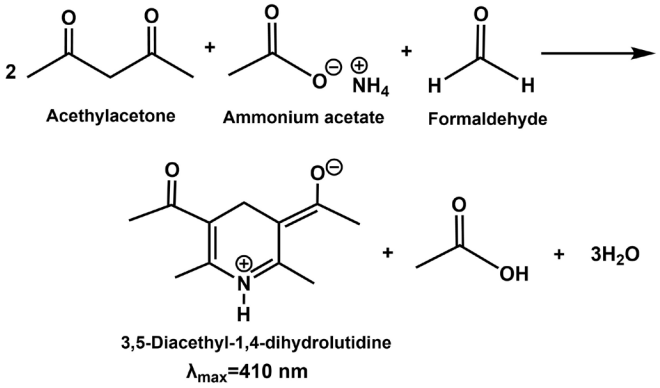

Fig. S1. Reaction scheme for 3,5-diacetyl-1,4-dihydrolutidine production from acethylacetone, ammonium acetate and formaldehyde.

The calibration curve for quantifying the formaldehyde concentration was determined by the following method. 86.7 g of ammonium acetate (1.1 mol) were dissolved in 500 mL of pure water (2.2 M). 4.56 mL of acetic acid (79.8 mmol) were dissolved in 50 mL of pure water (1.6 M). Acetic acid / ammonium acetate buffer was prepared by mixing 500 mL of 2.2 M ammonium acetate and 40 mL of 1.6 M acetic acid aqueous solutions. The pH of acetic acid / ammonium acetate buffer was adjusted to be 6.53.

A Nash reagent was prepared by mixing 2 mL of acetic acid / ammonium acetate buffer and 2 mL of acetylacetone. 0.1 mL of formaldehyde aqueous solution (concentration: 0 ~ 135 μM) was added to the Nash reagent, heated at 60 °C. for 20 min, cooled with water for 5 min, and then allowed to stand at room temperature for 20 min. 2 mL of the solution was sampled and the absorbance at 410 nm based on the production of 3,5-diacetyl-1,4-dihydrolutidine was measured using UV-visible absorption spectrophotometer (HITACHI U-2910). Figure S2 shows the relationship between formaldehyde concentration and absorbance at 410 nm.

This relationship showed good linearity (coefficient of determination; r^2=0.999) and the formaldehyde concentration can be calibrated by the equation; $Abs._{410\ nm} = 2.7 \times 10^3$ [HCHO] (μM). Therefore, it was suggested that formaldehyde concentration is quantified from the change in absorbance at a wavelength of 410 nm.

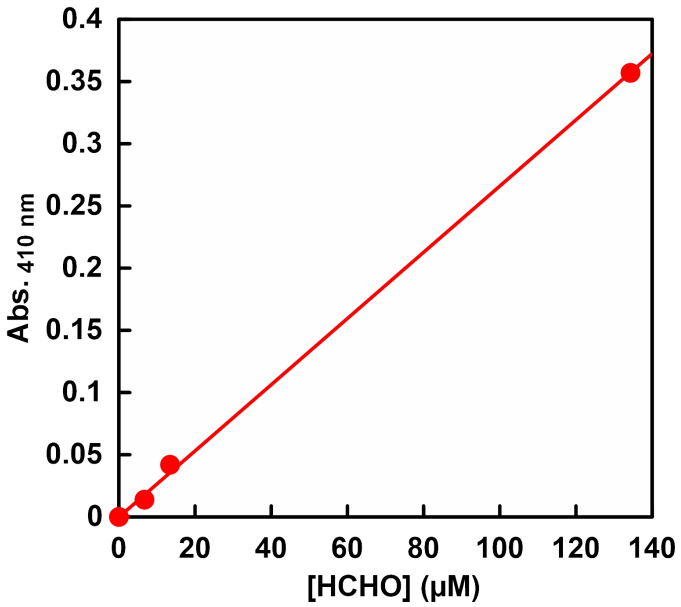

Fig. S2. The relationship between formaldehyde concentration and absorbance at 410 nm.

Reference

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