UNIVERSITAS
GADJAH MADA
Analisis Formaldehida pada Bakso Menggunakan Reagen Nash Melalui Kolorimetri Berbasis Citra Digital
Nabila Zulfa Rumaisha, Prof. Drs. Sri Juari Santosa, M. Eng., Ph.D.; Fajar Inggit Pambudi, S.Si., M.Sc., Ph.D.
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

ANALISIS FORMALDEHIDA PADA BAKSO MENGGUNAKAN REAGEN NASH MELALUI KOLORIMETRI BERBASIS CITRA DIGITAL

Nabila Zulfa Rumaisha
22/503844/PA/21666

INTISARI

Bakso merupakan produk olahan daging yang bersifat mudah rusak. Kondisi ini berpotensi terjadi penyalahgunaan formalin sebagai bahan pengawet ilegal walaupun penggunaannya dalam pangan sudah jelas dilarang. Formaldehida dapat dianalisis menggunakan reagen Nash karena bereaksi membentuk senyawa 3,5-diasetil-1,4-dihidrolutidin (DDL) berwarna kuning. Penelitian ini bertujuan untuk memperoleh kondisi optimum reaksi formaldehida dengan reagen Nash, membandingkan kinerja metode kolorimetri berbasis citra digital dengan spektrofotometri UV-Vis melalui parameter validasi, serta menerapkannya pada analisis formaldehida dalam sampel bakso pasar di beberapa wilayah Yogyakarta.

Penelitian diawali dengan optimasi reagen Nash yang mencakup variasi pH, suhu dan waktu pemanasan, serta tingkat kestabilan warna. Preparasi sampel bakso dilakukan melalui metode distilasi sebelum akhirnya direaksikan dengan reagen Nash. Pengukuran dilakukan menggunakan spektrofotometri UV-Vis dan kolorimeter berbasis citra digital yang membaca nilai RGB. Validasi metode dilakukan secara menyeluruh lewat parameter linearitas, akurasi, presisi, LoD, LoQ, serta uji interferensi matriks yang melibatkan tiga kurva kalibrasi. Setelah itu, metode diterapkan pada sampel bakso pasar untuk melihat kandungan formaldehida pada sampel nyata.

Hasil optimasi menunjukkan kondisi terbaik pada pH 6, suhu 40 °C, waktu pemanasan 30 menit, dan warna stabil pada 50–120 menit. Kedua metode memenuhi parameter validasi, seperti linearitas dengan R^2 mendekati 1, akurasi berkisar 96-105%, dan presisi sebesar 4,95% dan 0,224%. Akan tetapi metode spektrofotometri UV-Vis lebih sensitif dengan LoD 10,46 mg/kg dan LoQ 34,87 mg/kg, sedangkan kolorimetri memiliki LoD 41,70 mg/kg dan LoQ 139,01 mg/kg. Hasil uji interferensi menunjukkan bahwa matriks bakso dan tahapan preparasi penambahan larutan formaldehida pada sampel bakso sebelum destilasi memengaruhi respons analisis. Pada analisis sampel pasar, hasil menunjukkan bahwa metode kolorimetri citra digital masih dipengaruhi matriks bakso sehingga hasilnya belum cukup kuat untuk penetapan kadar kuantitatif pada sampel nyata. Penerapan kolorimetri berbasis citra digital lebih tepat diarahkan sebagai metode skrining cepat, sementara penetapan kadar tetap harus mengandalkan spektrofotometri UV-Vis.

Kata kunci: bakso, formalin, kolorimetri citra digital, reagen Nash, spekrofotometri UV-Vis.

UNIVERSITAS
GADJAH MADA
Analisis Formaldehida pada Bakso Menggunakan Reagen Nash Melalui Kolorimetri Berbasis Citra Digital
Nabila Zulfa Rumaisha, Prof. Drs. Sri Juari Santosa, M. Eng., Ph.D.; Fajar Inggit Pambudi, S.Si., M.Sc., Ph.D.
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

ANALYSIS OF FORMALDEHYDE IN MEATBALLS USING THE NASH REAGENT THROUGH DIGITAL IMAGE-BASED COLORIMETRY

Nabila Zulfa Rumaisha
22/503844/PA/21666

ABSTRACT

Meatballs are a processed meat product that spoils easily. This condition has the potential to lead to the misuse of formalin as an illegal preservative, even though its use in food is clearly prohibited. Formaldehyde can be analyzed using Nash's reagent because it reacts to form the yellow compound 3,5-diacetyl-1,4-dihydrolutidine (DDL). This study aims to determine the optimal reaction conditions between formaldehyde and Nash's reagent, to compare the performance of digital image-based colorimetry methods with UV-Vis spectrophotometry using validation parameters, and to apply these methods to the analysis of formaldehyde content in market meatball samples from several regions in Yogyakarta.

The study began with the optimization of the Nash reagent, which involved varying the pH, temperature, and heating time, as well as assessing color stability. Meatball samples were prepared using a distillation method before being reacted with the Nash reagent. Measurements were performed using UV-Vis spectrophotometry and a digital image-based colorimeter that reads RGB values. Method validation was conducted comprehensively through parameters of linearity, accuracy, precision, LoD, LoQ, and matrix interference testing involving three calibration curves. The method was then applied to market meatball samples to determine the formaldehyde content in real samples.

Optimization results indicated that optimal conditions are at pH 6, 40 °C, a heating time of 30 minutes, and color stability between 50 and 120 minutes. Both methods fulfilled the validation parameters, such as linearity with an R^2 value close to 1, accuracy ranging from 96–105%, and precision of 4.95% and 0,224%. However, the UV-Vis spectrophotometry method is more sensitive, with a limit of detection (LoD) of 10.46 mg/kg and a limit of quantification (LoQ) of 34.87 mg/kg, whereas the colorimetric method has a LoD of 41.70 mg/kg and a LoQ of 139.01 mg/kg. Interference test results indicate that the meatball matrix and the preparation step involving the addition of formaldehyde solution to the meatball samples before distillation affect the analytical response. In the analysis of market samples, the results showed that the digital image-based colorimetric method is still affected by the meatball matrix, so the results are not yet robust enough for quantitative determination in real samples. The application of digital image-based colorimetry is more appropriately directed as a rapid screening method, while quantitative determination must still rely on UV-Vis spectrophotometry.

Keywords: digital image colorimetry, formalin, meatballs, Nash reagent, UV-Vis spectrophotometry.