METHOD IDENTIFICATION OF PCR-BASED AND ELISA-BASED PORCINE DETECTION ON HIGHLY PROCESSED COLLAGEN SAMPLES FOR HALAL AUTHENTICATION

CAMILLA DEWANTHY PUTRI BASUKI

DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY
FACULTY OF AGRICULTURAL TECHNOLOGY
IPB UNIVERSITY
BOGOR
2024

STATEMENT LETTER OF MANUSCRIPT, SOURCES OF INFORMATION, AND DELEGATION OF COPYRIGHTS

I hereby declare that the manuscript with the title of "Method Identification of PCR-Based and ELISA-Based Porcine Detection on Highly Processed Collagen Samples for Halal Authentication" is truthfully my work under the guidance of the supervision committee and has never been published on any academic or institutional platform in any form. Sources of information taken or cited from other published and/or unpublished articles have been stated in the text and bibliography at the end of the manuscript.

With this, I bestow the copyright of this manuscript to IPB University.

Bogor, August 2024

Camilla Dewanthy Putri Basuki
F2401201804

ABSTRAK

CAMILLA DEWANTHY PUTRI BASUKI. Identifikasi Metode Deteksi Turunan Babi Berbasis PCR dan ELISA pada Sampel Kolagen yang Diproses Tinggi untuk Otentikasi Halal. Dibimbing oleh AZIS BOING SITANGGANG.

Kolagen adalah salah satu bahan umum dan merupakan protein penting yang digunakan dalam produk olahan, seperti industri makanan, kosmetik, farmasi, dan biomedis karena kegunaannya yang beragam. Sumber utama kolagen adalah babi, sapi, dan hewan laut. Hal ini sering diambil dari kulit, tulang, tendon, dan kulit hewan, seperti babi dan sapi, pada skala industri. Penelitian ini bertujuan untuk mengidentifikasi metode alternatif yang mendeteksi protein dengan *enzyme-linked immunosorbent assay* (ELISA) terhadap metode PCR DNA saat ini. Sampel kolagen yang diproses secara berlebih (*highly processed*) dideteksi secara akurat sebagai positif atau negatif berasal dari babi, serta menghitung *False Negative Rate* dari setiap metode. Hasilnya menunjukkan bahwa jumlah sampel kolagen babi yang diproses secara berlebih (*highly processed*) terdeteksi positif imbang pada setiap metode. Temuan ini menunjukkan bahwa ketika menerapkan prosedur di laboratorium, kombinasi *real-time* PCR dan ELISA berpotensi lebih efektif dalam mengautentikasi sampel produk secara tepat. Misalnya, ketika mendeteksi babi dengan produk kolagen tipe II yang tidak didenaturasi (*undenatured*), *real-time* PCR akan bermanfaat untuk deteksi konsentrasi rendah, sementara ELISA dapat membantu mengatasi negatif palsu (*false negative*) yang disebabkan oleh DNA terdegradasi atau terfragmentasi, penghambatan PCR, dan kontaminasi protein oleh protein kolagen itu sendiri.

Kata kunci: babi, ELISA, *highly processed*, kolagen, PCR

ABSTRACT

CAMILLA DEWANTHY PUTRI BASUKI. Method Identification of PCR-Based and ELISA-Based Porcine Detection on Highly Processed Collagen Samples for Halal Authentication. Supervised by AZIS BOING SITANGGANG.

Collagen is among the common ingredients and an essential protein used in highly processed products, such as food, cosmetic, pharmaceutical, and biomedical industries because of its diverse uses. The main sources of collagen are pigs, cows, and marine animals. It is frequently collected from the hides, bones, tendons, and skin of animals like pigs and cows on the industrial basis. This research aims to identify an alternative protein approach with enzyme-linked immunosorbent assay (ELISA) to the current DNA method of PCR. Therefore, highly processed collagen samples can be accurately detected as positive or negative for porcine, as well as calculate the False Negative Rate of each method. The results showed that the same amount of highly processed porcine collagen samples was accurately detected as positive with each method. The findings suggest that when employing this current procedure in the laboratory, a combination of real-time PCR and ELISA may be more effective in precisely authenticating the product sample. For example, when detecting porcine with undenatured type II collagen products, real-time PCR would be advantageous for low-level detection, while ELISA may aid in overcoming false negatives caused by degraded or fragmented DNA, PCR inhibition, and protein contamination by the collagen proteins themselves.

Keywords: collagen, ELISA, highly processed, PCR, porcine

METHOD IDENTIFICATION OF PCR-BASED AND ELISA-BASED PORCINE DETECTION ON HIGHLY PROCESSED COLLAGEN SAMPLES FOR HALAL AUTHENTICATION

CAMILLA DEWANTHY PUTRI BASUKI

Undergraduate thesis
as a requirement for obtaining a
Bachelor's degree in
Food Technology

DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY
FACULTY OF AGRICULTURAL TECHNOLOGY
IPB UNIVERSITY
BOGOR
2024

Examiners in the Undergraduate Thesis Examination:

1 Dr. Inas Suci Rahmawati, S.T.P., M.Si
2 Dr. Vallerina Armetha, S.T.P., M.Si

Thesis Title : Method Identification of PCR-Based and ELISA-Based Porcine Detection on Highly Processed Collagen Samples for Halal Authentication
Name : Camilla Dewanthy Putri Basuki
NIM : F2401201804

Approved by

Supervisor 1:
Prof. Dr.-Ing. Azis Boing Sitanggang, M.Sc
NIP. 198609112010121007

Acknowledged by

Head of Department of
Food Science and Technology:
Dr. Eko Hari Purnomo, STP, M.Sc
NIP. 19760412199031004

Exam Date:
13 September 2024

Validation Date:

FOREWORD

All praise and thanks to Allah *subhanaahu wa ta'ala* for all His sustenance so that this scientific work was successfully completed. Peace and blessings be upon the last Prophet Muhammad *shallallahu 'alaihi wa sallam*, his family, his best generations, and those who constantly follow him until the end of time. The topic chosen in the research carried out from May to July 2024 is with the title "Method Identification of PCR-Based and ELISA-Based Porcine Detection on Highly Processed Collagen Samples for Halal Authentication".

The author would like to thank her supervisor, Prof. Dr.-Ing. Azis Boing Sitanggang, M.Sc, who has guided and given various advice. Thank you as well to the examiners and technical implementation unit. In addition, the author's appreciation goes to Ruzanna Zainal, Nazihah Ab Hamid, Nur Syahirah Atiqah Amru Hisham, the management, and all staff as well as interns of Halvec Laboratories Sdn. Bhd. who have helped during constructing the project scope, training, data collection, and the whole amazing internship experience. Therefore, the data presented is a shared property with Halvec Laboratories Sdn. Bhd., Malaysia. Not to forget, Dr. Nazrizawati, Dr. Siti Aimi Sarah binti Zainal Abidin, and Dr. Siti Roha Ab Mutalib as lecturers in Universiti Teknologi Mara, Shah Alam, Malaysia during the AIMS 2023 program, who have helped lead the way so that this research internship can be conducted. Expressions of a huge thank you are also conveyed to her father, mother, and the entire family who have provided support, prayers, and love, as well as FST 57 especially K4, Al Hurriyyah Care along with LKM Al Hurriyyah IPB, Bismillah Tholabul 'Ilm members, Revivers IIUM, Parkhill Residence roommates, and others whom she cannot mention one by one, may Allah recompense every one of them with goodness.

Hopefully, this scientific work will be useful for those in need and for the advancement of science.

Bogor, August 2024

Camilla Dewanthy Putri Basuki

TABLE OF CONTENT

LIST OF TABLES