

**UNIVERSITI SAINS MALAYSIA  
GERAN PENYELIDIKAN UNIVERSITI PENYELIDIKAN  
LAPORAN AKHIR**

**EVALUATION OF GLASS IONOMER CEMENTS  
(GICs) PROPERTIES WITH COUMARIN DERIVATIVES AS  
ANTIBACTERIAL AGENT**

**PENYELIDIK**

**PROF. MADYA DR. DASMAWATI MOHAMAD**

**PENYELIDIK BERSAMA**

**PROF. ISMAIL AB. RAHMAN  
PROF. HABSAH HASAN  
PROF. HASNAH OSMAN**

**2017**



**USM** UNIVERSITI  
SAINS  
MALAYSIA



## **RESEARCH UNIVERSITY (INDIVIDUAL) GRANT REPORT**

**RU 1001/PPSG/813076**

**EVALUATION OF GLASS IONOMER CEMENTS (GICS) PROPERTIES  
WITH COUMARIN DERIVATIVES AS ANTIBACTERIAL AGENT**

### **RESEARCHERS :**

**ASSOC. PROF DR. DASMAWATI MOHAMAD**

**PROF. ISMAIL AB RAHMAN**

**PROF. HABSAH HASAN**

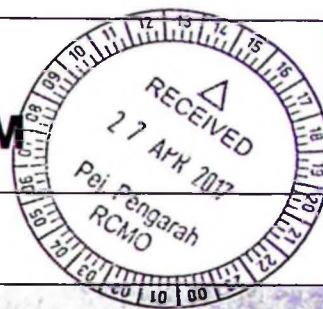
**PROF. HASNAH OSMAN**

**2017**

Project Code :  
(for RCMO use only)



# RU GRANT FINAL REPORT FORM



Please email a softcopy of this report to [rcmo@usm.my](mailto:rcmo@usm.my)

<b>A</b>	<b>PROJECT DETAILS</b>
<b>i</b>	<b>Title of Research:</b> Evaluation of Glass Ionomer Cements (GICs) Properties With Coumarin Derivatives As Antibacterial Agent
<b>ii</b>	<b>Account Number:</b> 1001/PPSG/813076
<b>iii</b>	<b>1. Name of Research Leader:</b> Assoc. Prof. Dr Dasmawati Binti Mohamad
<b>v</b>	<b>Name of Co-Researcher:</b>  1. Prof. Ismail Ab Rahman 2. Prof. Hasnah Osman 3. Prof. Habsah Hasan
	<b>Duration of this research:</b>  a) <b>Start Date</b> : 15 December 2012 b) <b>Completion Date</b> : 14 December 2015 c) <b>Duration</b> : 3 years 6 months d) <b>Revised Date (if any)</b> : 14 June 2016
	<b>ABSTRACT OF RESEARCH</b>  <i>(An abstract of between 100 and 200 words must be prepared in Bahasa Malaysia and in English. This abstract will be included in the Report of the Research and Innovation Section at a later date as a means of presenting the project findings of the researcher/s to the University and the community at large)</i>  <u>Title : Evaluation of Glass Ionomer Cements (GICs) Properties With Coumarin Derivatives As Antibacterial Agent</u>  Glass ionomer cements (GIC) are widely used as dental restorative materials due to their aesthetics features and fluoride content. However, a capability of fluoride content in GIC to inhibit bacteria growth in an oral environment was insufficient for a long term which may leads to secondary caries. Therefore, the objective of this research was to fabricate a new GICs with coumarin derivatives as an antibacterial agent. 3-Acetylcoumarin (1) and hydrazine thiosemicarbazide coumarin derivatives (2) have been successfully synthesized at laboratory scale. Their structural identification was confirmed by Fourier Transform Infrared



(FTIR) and Nuclear Magnetic Resonance (NMR) analysis. Both synthesized compounds were fabricated with GICs at percentage of 0.5, 1.0, 1.5, 2.0 and 2.5. The antibacterial activities of tested materials were assessed by agar diffusion test (ADT) and bacteria growth. The effect of incorporation of 3-acetylcoumarin (3-AC) on the mechanical properties and surface morphology of glass ionomer cement (GIC) were evaluated. Flexural strength of the specimens were analysed using Shimadzu AGX-Plus while morphological evaluation of the specimens were observed using Scanning Electron Microscope. An in-vitro cytotoxicity study of the synthesised coumarin derivatives were screened using a 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay on Human Periodontal Ligament Fibroblast (HPDLF) cells. Release profile of 3-Acetylcoumarin (GIC-1) and hydrazinyl thiosemicarbazide of coumarin derivatives (GIC-2) at three different concentrations of 0.5, 1.0 and 1.5 % were evaluated using Microplate Reader up to 30 days. Both synthesized coumarin derivatives showed very promising properties as an antibacterial agent to be incorporated with GIC.

**Tajuk: Penilaian Sifat-sifat Simen Ionomer Kaca (GICs) Mengandungi Derivatif Kumarin Sebagai Agen Antibakteria**

**Abstrak**

Simen ionomer kaca (GIC) banyak digunakan secara meluas sebagai bahan restoratif pergig disebabkan oleh ciri estetik dan kandungan fluoridanya. Walau bagaimanapun, kebolehan kandungan florida dalam GIC untuk merencatkan pertumbuhan bakteria dalam persekitaran oral tidak mencukupi dalam jangka masa yang panjang di mana ia boleh menyebabkan masalah karies sekunder. Oleh sebab itu, objektif bagi kajian ini adalah untuk memfabrikasi GICs yang baru dengan kandungan derivatif kumarin sebagai agen antibakteria. 3-Asetilkumarin (1) dan hidrazina tiosemikarbazid kumarin derivatif (2) telah berjaya disintesis pada skala makmal. Identifikasi struktur kimia kedua-dua bahan tersebut telah berjaya disahkan dengan menggunakan analisis Spektroskopi Transformasi Inframerah Fourier (FTIR) dan Nuklear Magnetic Resonans (NMR). Kedua-dua bahan sintesis tersebut telah difabrikasi bersama dengan GIC pada peratusan 0.5, 1.0, 1.5, 2.0 dan 2.5. Aktiviti antibakteria pada bahan yang diuji telah ditaksir dengan menggunakan Ujian Resapan Agar (ADT) dan pertumbuhan bakteria. Kesan penggabungan 3-Asetilkumarin(3-AC) pada sifat mekanikal dan morfologi permukaan simen ionomer kaca (GIC) telah diuji. Kekuatan lentur pada spesimen dianalisa dengan menggunakan Shimadzu AGX-Plus, sementara itu penilaian morfologikal pada spesimen diperhatikan dengan menggunakan Mikroskop Elektron Imbasan (SEM). Kajian in vitro sitotoksikiti pada derivatif kumarin tersintesis disaring dengan menggunakan (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) assay ke atas Sel Ligamen Periodontal Fibroblast Manusia (HPDLF). Profil pelepasan 3-Asetilkumarin (GIC-1) dan hidrazina tiosemikarbazida kumarin derivatif (GIC-2) pada tiga kepekatan yang berbeza iaitu 0.5, 1.0 dan 1.5 % telah diuji dengan menggunakan Mikroplate Reader selama 30 hari. Kedua-dua kumarin derivative tersintesis menunjukkan sifat yang memberangsangkan sebagai agen antibakteria yang diinkorporasi dengan GIC.

**C BUDGET & EXPENDITURE**

<b>i</b>	<b>Total Approved Budget</b>	: RM 152,490.00
	<u><b>Yearly Budget Distributed</b></u>	
	Year 1	: RM 95,790.00
	Year 2	: RM 48,950.00
	Year 3	: RM 7,750.00
	<b>Total Expenditure</b>	: RM 150,992.24
	<b>Balance</b>	: RM 1,497.76
	<b>Percentage of Amount Spent (%)</b>	: 99.02%

*# Please attach final account statement (eStatement) to indicate the project expenditure*