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Patent Search

Invention Title	AUTOMATED LOWER LIMB EXERCISING DEVICE
Publication Number	52/2022
Publication Date	30/12/2022
Publication Type	INA
Application Number	202211072925
Application Filing Date	16/12/2022
Priority Number	
Priority Country	
Priority Date	
Field Of Invention	ELECTRICAL
Classification (IPC)	A63B0024000000, A63F0013670000, H04L0009080000, A63B0026000000, B61B0001020000

Inventor

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Dr. Khushmeet Kumar	Professor, Mechanical Engineering Department, Baddi University of Emerging Sciences and Technology, Baddi, Himachal Pradesh - 173205, Indian.	India	India

Applicant

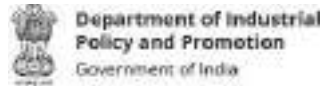
Name	Address	Country	Nationality
University of Engineering and Technology Roorkee	Post Box No.27, 7 Km. on Roorkee - Haridwar Road, Vardhmanpuram, Roorkee, Uttarakhand - 247667, India.	India	India

Abstract:

An automated lower limb exercising device comprises a platform 1 over which a display panel 2 is installed for providing input regarding user desired difficulty level, an artificial intelligence (AI) based imaging unit 4 installed on platform 1 for capturing multiple images of platform 1 to determine user's physique, multiple extendible rectangular panels 5 installed on platform 1 adjacent with each other in order to get extract/retract as per user's physique, a flap 6 is hinged to lateral sides of panels 5 for positioning the leg in an alternate manner to perform an limb exercise, multiple telescopic bars 7 installed underneath panels 5 for adjusting height with respect to difficulty level, the hydraulic rods 8 positioned underneath flaps 6 to adjust the angle of flap 6 with respect to panel 5, a set of electromagnets is integrated with flaps 6 and braces 3 for providing resistance to the user.

- 5) The device as claimed in claim 1, wherein in case of expert level, said panels 5 are maintained at an ascending height above a threshold level, while said flaps 6 are oriented at a lesser moderate angle with generation of magnetic force of attraction above a threshold strength to pose difficulty for said user in performing said exercise.
- 6) The device as claimed in claim 1, wherein a FBG (Fiber Bragg Grating) sensor is fabricated on said clamp for monitoring vital health parameters of said user while performing said exercise and in case said monitored parameters exceeds/recedes from a threshold limit, said microcontroller actuates said panel 2 to display a warning for said user to withdraw said exercise.
- 7) The device as claimed in claim 1, wherein plurality of pressure sensors are fabricated on said flaps 6 for monitoring pressure exerted by said user's foot on said flap 6 and in case said monitored pressure exceeds/recedes from a threshold range as per said difficulty level, said microcontroller actuates said panel 2 to display suggestions for said user to correct said user's stance while performing said exercise.
- 8) The device as claimed in claim 1, wherein a holographic projector 11 is installed on said platform 1 that is actuated by said microcontroller to project a virtual image of correct body posture required for performing said exercise in order to guide said user to attain said correct body posture, in case said fed input corresponds to a beginner level.

[View Application Status](#)



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Page last updated on: 26/06/2019



Office of the Controller General of Patents, Designs & Trade Marks
 Department of Industrial Policy & Promotion,
 Ministry of Commerce & Industry,
 Government of India.



P 1

Application Details

APPLICATION NUMBER	202241040852
APPLICATION TYPE	ORDINARY APPLICATION
DATE OF FILING	18/07/2022
APPLICANT NAME	1. Dr. Nethravathi K 2. Dr. Shvangee Tawari 3. Dr. Preeti Mishra 4. Dr. Melanie Lourens 5. Vinay Kumar Yadav 6. Dr. Sankalp Srivastava 7. Dr. Aron Kant Painoli 8. Dr. LB Muralidhar 9. M.Antony 10. Dr. Geetha Mohanta 11. Dr. Deo karan Ram
TITLE OF INVENTION	Methodology for Strategic planning model to increase the profitability of a Human Resources outsourcing SME through the use of digital transformation
FIELD OF INVENTION	COMPUTER SCIENCE
E-MAIL (As Per Record)	szsulferrh2019@gmail.com
ADDITIONAL E-MAIL (As Per Record)	sz2softtech3019@gmail.com
E-MAIL (UPDATED Channel)	
PRIORITY DATE	
REQUEST FOR EXAMINATION DATE	
PUBLICATION DATE (3/5 11A)	22/07/2022

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ORIGINAL
क्रम सं/ Serial No. : 147192



पेटेंट कार्यालय, भारत सरकार

The Patent Office, Government Of India

डिजाइन के पंजीकरण का प्रमाण पत्र

Certificate of Registration of Design

डिजाइन सं. / Design No. : 393714-001
 तारीख / Date : 26/08/2023
 पारस्परिकता तारीख / Reciprocity Date* :
 देश / Country :

प्रमाणित किया जाता है कि संलग्न प्रति में वर्णित डिजाइन जो *SEMI-AUTOMATIC INTRANASAL DRUG DELIVERY DEVICE* से संबंधित है, का पंजीकरण, श्रेणी 24-01 में 1.Mr. Devinder Kumar 2. Mr. Harsimran Singh 3.Mr. Vineet Kapoor 4.Gurpreet Kaur 5.Anupama Kumari 6.Neha Gupta 7.Ankita Sharma 8.Hema Rani 9.Manjula Devi के नाम में उपर्युक्त संख्या और तारीख में कर लिया गया है।

Certified that the design of which a copy is annexed hereto has been registered as of the number and date given above in class 24-01 in respect of the application of such design to *SEMI-AUTOMATIC INTRANASAL DRUG DELIVERY DEVICE* in the name of 1.Mr. Devinder Kumar 2. Mr. Harsimran Singh 3.Mr. Vineet Kapoor 4.Gurpreet Kaur 5.Anupama Kumari 6.Neha Gupta 7.Ankita Sharma 8.Hema Rani 9.Manjula Devi.

डिजाइन अधिनियम, 2000 तथा डिजाइन नियम, 2001 के अध्याधीन प्रावधानों के अनुसरण में।

In pursuance of and subject to the provisions of the Designs Act, 2000 and the Designs Rules, 2001.

जारी करने की तिथि : 30/10/2023
 Date of Issue



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Innovation Patent

Patent no: 2021107463

Patentee(s):	Thakur, Rahul of Department of Biotechnology MMEC Maharishi Markandeshwar (Deemed to be University), Mullana Ambala Haryana India Chandan, Gaurav DR of Department of Biotechnology MMEC Maharishi Markandeshwar (Deemed to be University), Mullana Ambala Haryana India Mittal, Divya DR of Department of Biotechnology MMEC Maharishi Markandeshwar (Deemed to be University), Mullana Ambala Haryana India Gupta, Bhuvanesh PROF of Bioengineering Laboratory Department of Textile Technology Indian Institute of Technology New Delhi India Saini, Vipin DR of Maharishi Markandeshwar University Sadopur Ambala Haryana India Kumari, Sarita MRS of Department of Education Government of Himachal Pradesh Himachal Pradesh India Sharma, Arush MR of School of Sciences Baddi University of Emerging Sciences and Technology (BUEST) Solan Himachal Pradesh India Saini, Reena V. DR of Department of Biotechnology MMEC Maharishi Markandeshwar (Deemed to be University), Mullana Ambala Haryana India Pathania, Deepak PROF of Department of Chemistry Sardar Vallabhbhai Patel Cluster University Mandi Himachal Pradesh India Saini, Adesh Kumar PROF of Department of Biotechnology MMEC Maharishi Markandeshwar (Deemed to be University), Mullana Ambala Haryana India
Inventor(s):	Saini, Adesh Kumar Pathania, Deepak Saini, Reena V. Sharma, Arush Kumari, Sarita Saini, Vipin Gupta, Bhuvanesh Mittal, Divya Chandan, Gaurav Thakur, Rahul
Title:	Green facile synthesis of Ag-doped Cu/ZnO nanocomposite (G-AgNC) using leaf extract of Melia azedarach as a capping agent for biomedical applications
Term:	Eight years from 25 August 2021
Date Granted:	8 December 2021
Date Certified:	
Date of Patent:	25 August 2021
Status:	GRANTED

Expiry Date: 25 August 2029

Date Ceased:

Date Revoked:



Australian Government

IP Australia

CERTIFICATE OF GRANT INNOVATION PATENT

Patent number: 2021107462

The Commissioner of Patents has granted the above patent on 8 December 2021, and certifies that the below particulars have been registered in the Register of Patents.

Name and address of patentee(s):

Deepak Pathania of Department of Environmental Sciences, Central University of Jammu, Bagla(RahyaSuchani) Samba Jammu and Kashmir India

Adesh Kumar Saini of Department of Biotechnology, MMEC, Maharishi Markandeshwar (Deemed to be University), Mullana Ambala Haryana India

Reena V. Saini of Department of Biotechnology, MMEC, Maharishi Markandeshwar (Deemed to be University), Mullana Ambala Haryana India

Arush Sharma of School of Sciences, Baddi University of Emerging Sciences and Technology, (BUEST) Solan Himachal Pradesh India

Sarita Kumari of Department of Education, Government of Himachal Pradesh Himachal Pradesh India

Bhuvanesh Gupta of Bioengineering Laboratory, Department of Textile Technology Indian Institute of Technology New Delhi India

Divya Mittal of Department of Biotechnology, MMEC, Maharishi Markandeshwar (Deemed to be University), Mullana Ambala Haryana India

Gaurav Chandan of Department of Biotechnology, MMEC, Maharishi Markandeshwar (Deemed to be University), Mullana Ambala Haryana India

Rahul Thakur of Department of Biotechnology, MMEC, Maharishi Markandeshwar (Deemed to be University), Mullana Ambala Haryana India

Vipin Saini of Professor, Maharishi Markandeshwar University, Sadopur Ambala Haryana India

Title of invention:

Robust facile synthesis of Mangifera indica biochar supported Ag/Cu-ZrO₂ hetero-nanostructure for biomedical applications

Name of inventor(s):

Pathania, Deepak; Saini, Adesh Kumar; Saini, Reena V.; Sharma, Arush; Kumari, Sarita; Gupta, Bhuvanesh; Mittal, Divya; Chandan, Gaurav; Thakur, Rahul and Saini, Vipin

Term of Patent:

Eight years from 25 August 2021

NOTE: This Innovation Patent cannot be enforced unless and until it has been examined by the Commissioner of Patents and a Certificate of Examination has been issued. See sections 120(1A) and 129A of the Patents Act 1990, set out on the reverse of this document.



Dated this 8th day of December 2021

Commissioner of Patents

PATENTS ACT 1990

The Australian Patents Register is the official record and should be referred to for the full details pertaining to this IP Right.



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CERTIFICATE OF GRANT INNOVATION PATENT

Patent number: 2021107462



Dated this 8th day of December 2021

Commissioner of Patents

PATENTS ACT 1990

The Australian Patents Register is the official record and should be referred to for the full details pertaining to this IP Right.



ORIGINAL
क्रम सं/ Serial No. : 144476



पेटेंट कार्यालय, भारत सरकार

The Patent Office, Government Of India

डिजाइन के पंजीकरण का प्रमाण पत्र

Certificate of Registration of Design

डिजाइन सं. / Design No. : 391228-001
 तारीख / Date : 26/07/2023
 पारस्परिकता तारीख / Reciprocity Date* :
 देश / Country :

प्रमाणित किया जाता है कि संलग्न प्रति में वर्णित डिजाइन जो *TRANSDERMAL PATCH FOR DIABETES MANAGEMENT* से संबंधित है, का पंजीकरण, श्रेणी 24-04 में 1.Dr Ravinesh Mishra 2. Asheesh Pratap Singh 3.Dr Rizwana Khan 4.Srijani Dasgupta 5.Dr Ashutosh Kumar Yadav 6.Dr Nripendra Singh 7.Dr Chirag Goda 8.Vijay Nagesh Gunjkar 9.Dr Saurabh Singh 10.Priyanka Sharma के नाम में उपर्युक्त संख्या और तारीख में कर लिया गया है।

Certified that the design of which a copy is annexed hereto has been registered as of the number and date given above in class 24-04 in respect of the application of such design to *TRANSDERMAL PATCH FOR DIABETES MANAGEMENT* in the name of 1.Dr Ravinesh Mishra 2. Asheesh Pratap Singh 3.Dr Rizwana Khan 4.Srijani Dasgupta 5.Dr Ashutosh Kumar Yadav 6.Dr Nripendra Singh 7.Dr Chirag Goda 8.Vijay Nagesh Gunjkar 9.Dr Saurabh Singh 10.Priyanka Sharma.

डिजाइन अधिनियम, 2000 तथा डिजाइन नियम, 2001 के अध्याधीन प्रावधानों के अनुसरण में।

In pursuance of and subject to the provisions of the Designs Act, 2000 and the Designs Rules, 2001.

जारी करने की तिथि : 25/09/2023
 Date of Issue



महानियंत्रक पेटेंट, डिजाइन और व्यापार चिह्न
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Design Application Details

Application Number: 391120-001
Cbr Number: 209231
Cbr Date: 25/07/2023 18:57:23
Applicant Name:

1. Dr Shahbaz Khan
2. Dr Kiran Bala
3. Dr Basanti Brar
4. Rashmi Dorai
5. Shavej Husain
6. Dr Yogesh Joshi
7. Dr Brajesh Kumr Garg
8. Himanshu Sharma
9. Dr Ravinesh Mishra
10. Dr Chirag Goda

Design Application Status

Application Status: Application Under Process(wating for Technical Examination)

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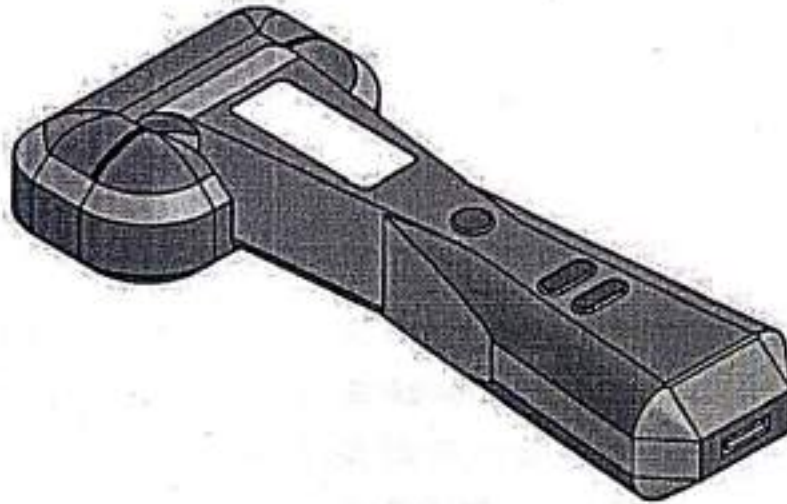
(SPECIMEN OF REPRESENTATION SHEETS)

Name of Applicant:

- | | | | |
|-------------------------|--------------------|-----------------------|--------------------|
| 1. Dr Shahbaz Khan | 2. Dr Kiran Bala | 3. Dr Basanti Brar | |
| 4. Rashmi Dorai | 5. Shavej Husain | 6. Dr Yogesh Joshi | |
| 7. Dr Brajesh Kumr Garg | 8. Himanshu Sharma | 9. Dr Ravinesh Mishra | 10. Dr Chirag Goda |

Total Pages: 7

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PERSPECTIVE VIEW

The novelty resides in the shape and configuration of the **“DEVICE FOR EARLY DETECTION OF DIABETIC NEUROPATHY TOPICALLY”** as illustrated.

No claim is made by virtue of this registration in respect of any mechanical or other action of any mechanism whatever or in respect of any mode or principle of construction of the Article.

No claim is made by virtue of this registration to any right to the exclusive use of the words, letters, numbers, or trade marks appearing in the representation.

Design Application Details

Application Number: 391228-001

Cbr Number: 209306

Cbr Date: 26/07/2023 18:57:30

Applicant Name:

1. Dr Ravinesh Mishra
2. Asheesh Pratap Singh
3. Dr Rizwana Khan
4. Srijani Dasgupta
5. Dr Ashutosh Kumar Yadav
6. Dr Nripendra Singh
7. Dr Chirag Goda
8. Vijay Nagesh Gunjkar
9. Dr Saurabh Singh
10. Priyanka Sharma

Design Application Status

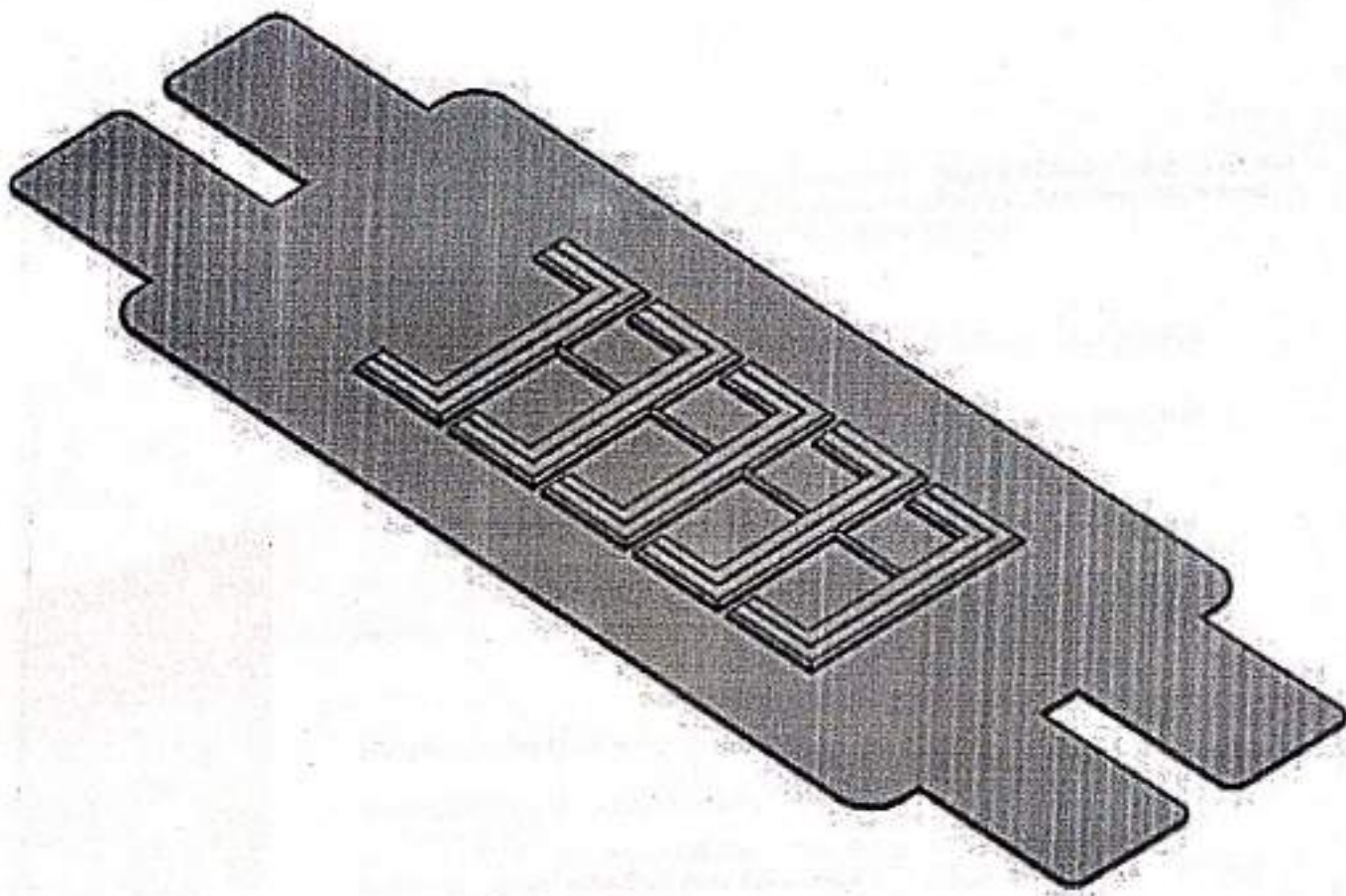
Application Status: Application Under Process(waiting for Technical Examination)

[BACK](#)

(SPECIMEN OF REPRESENTATION SHEETS)

Applicant:
1. Avinash Mishra
2. Asheesh Pratap Singh
3. Dr Rizwana Khan
4. Anil Dasgupta
5. Dr Ashutosh Kumar Yadav
6. Dr Nripendra Singh
7. Chirag Goda
8. Vijay Nagesh Gunjkar
9. Dr Saurabh Singh
10. Priyanka Sharma

Total Pages: 4
Page 1 of 4



PERSPECTIVE VIEW

The novelty resides in the shape and configuration of the "TRANSDERMAL PATCH FOR DIABETES MANAGEMENT" as Illustrated.

Claim is made by virtue of this registration in respect of any mechanical or other invention or in respect of any mode or principle of construction as defined in Article 1.

Claim is made by virtue of this registration to any right to the exclusive use of the letters, numbers, or trademarks appearing in the representation.



Intellectual
Property
Office

Certificate of Registration for a UK Design

Design number: 6296237

Grant date: 22 July 2023

Registration date: 14 July 2023

This is to certify that,

In pursuance of and subject to the provision of Registered Designs Act 1949, the design of which a representation or specimen is attached, had been registered as of the date of registration shown above in the name of

Dr Nidagurthi Guggilla Raghavendra Rao, Dr Madhu Gupta, Dr Khanage

Shantaram Gajanan, Maryam Musa Kallah, Dr Saurabh Singh, Dr Daniel

Dhayabaran, Dr Chirag Goda, Dr Ravinesh Mishra

in respect of the application of such design to:

Portable device for stability studies measurements of Formulations

International Design Classification:

Version: 14-2023

Class: 24 MEDICAL AND LABORATORY EQUIPMENT

Subclass: 01 APPARATUS AND EQUIPMENT FOR DOCTORS, HOSPITALS
AND LABORATORIES

Adam Williams

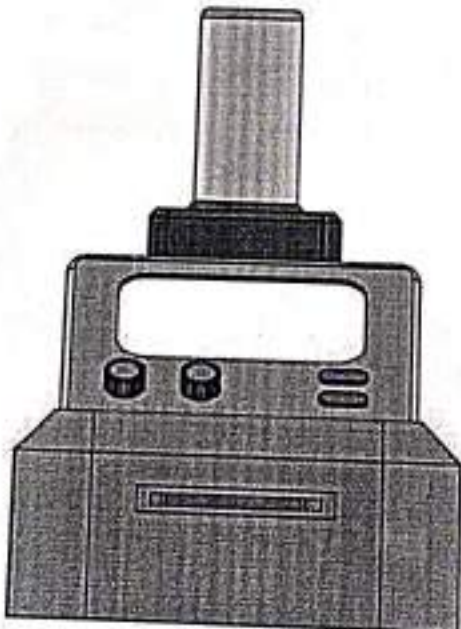
Adam Williams

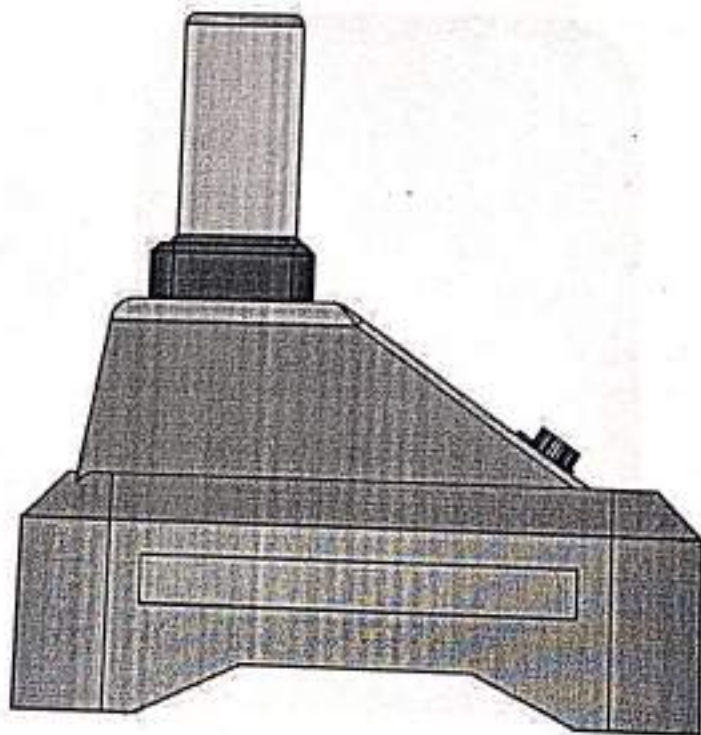
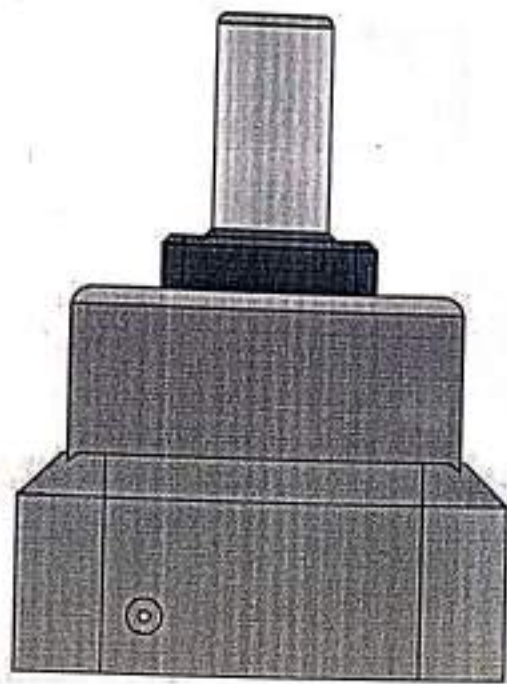
Comptroller-General of Patents, Designs and Trade Marks

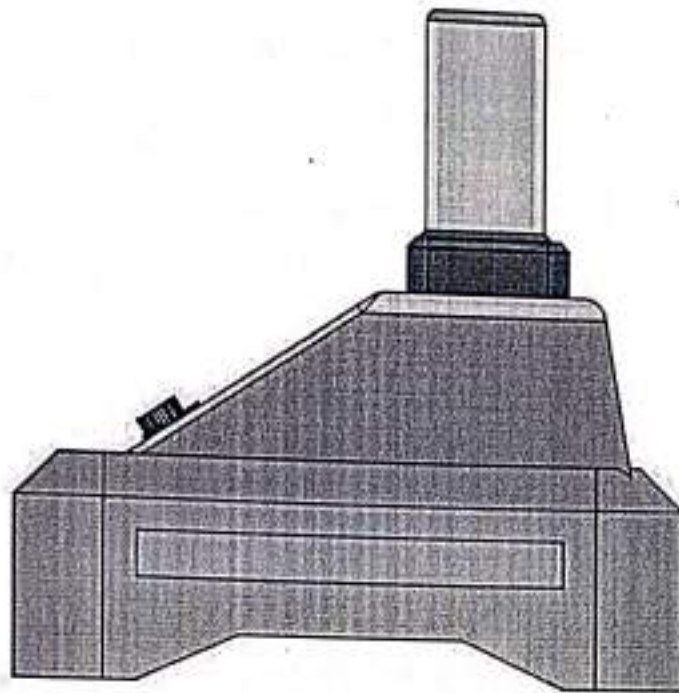
Intellectual Property Office

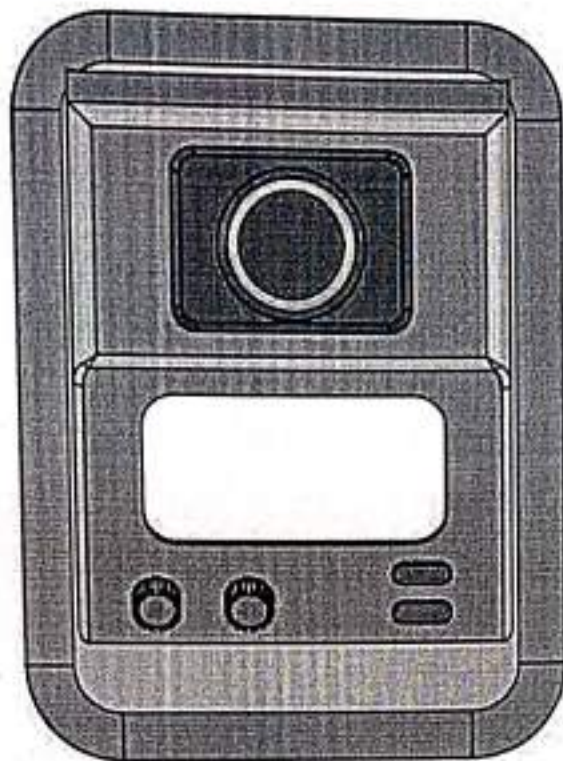
The attention of the Proprietor(s) is drawn to the important notes overleaf.











Form 21
General Power of authority to agent
(Section 43)

In connection with Filing, Prosecution and Registration of Design Application,

We,

Applicant (s)	Nationality	Address
Dr Shahbaz Khan	Indian	Assistant Professor, Pharmacy Academy, IFTM University, Moradabad, UP
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Dr Ravinesh Mishra	Indian	Professor, School of Pharmacy and Emerging Sciences, Baddi University of Emerging Sciences and Technology, Baddi, Himachal Pradesh, 173205
Dr Chirag Goda	Indian	Assistant Professor, Department of Pharmaceutical Sciences, Pharm. D. Program Ibn Sina National College, Jeddah 22421 Saudi Arabia

, hereby authorize

Page No. _____

Form 21
General Power of authority to agent
(Section 43)

In connection with Filing, Prosecution and Registration of Design Application,

We,

Applicant (s)	Nationality	Address
Dr Ravinesh Mishra	Indian	Professor, School of Pharmacy and Emerging Sciences, Baddi University of Emerging Sciences and Technology, Baddi, Himachal Pradesh, 173205
Asheesh Pratap Singh	Indian	Assistant Professor, DSSOP Pharmacy College, Siddharth Nagar, 272207, Uttar Pradesh, India.
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Dr Saurabh Singh	Indian	Professor, School of Pharmaceutical Sciences, Lovely Professional University, Punjab
Priyanka Sharma	Indian	Research Scholar, Pharmacology, Delhi Pharmaceutical Sciences and Research University, New Delhi

, hereby authorize



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1.	Project Scientific Assistant (B)	1	-	-	-	-	-	28	Rs.55,600/- consolidated pay	Rs.55,600/- consolidated pay (including HRA of Rs.8,602/-)

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1. Project Scientific Assistant (B): One (01) Post (UR):

Essential Qualification: Full time Science Graduate in Chemistry, Biology or Pharmacy with minimum 60% marks in aggregate.

Essential Experience: Minimum one (01) year active post qualification experience in a laboratory with Mass Spectrometry or Small-molecule/metabolite extraction/analyses or isotope ratiometric mass analyses.

Job Description:

- Routine operation of liquid chromatography mass spectrometry (LCMS/LCMSMS) which include regular tuning and calibration of mass spectrometer. Ability to plan, execute, troubleshoot, and resolve technical issues related to Mass spectrometry. Assist with mass spectrometry method development and validation.
- Hands-on experience of metabolite extraction from different types of samples e.g. tissues, cell or serum. Data acquisition, data analysis using MS-sofwares and interpretation of data. Provide assistance to laboratory personnel analysing and interpreting mass spectrometry data. Sample preparation for IRMS, acquisition and data analysis.
- Develop and maintain expertise in analysis software and metabolite databases related to mass spectrometry data analysis and processing. Analyse quantitative and qualitative data from mass spectrometers with high attention to detail. Perform statistical analysis. Develop expertise in data representation.
- Online and offline record keeping of samples available for analysis, samples processed and data storage. Keeping notes of mass spectrometry maintenance, troubleshooting, ordering and replacement of mass spectrometry accessories.

The candidates must furnish an up to date CV and a MANDATORY one-page cover letter in which the candidates should describe their professional background and experience, their motivation for applying to this particular position and in which terms they consider fit for this job.

(TOTAL 51 PAGES)

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IS, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(54) Title: NOVEL 5-[4-(2-BIPHENYL-4-YL-2-OXO-ETHOXY)-BENZYLIDENE]-THIAZOLIDINE-2,4-DIONES, THEIR SYNTHESIS AND USES THEREOF

(57) Abstract: Disclosed are novel 5-[4-(2-biphenyl-4-yl-2-oxo-ethoxy)-benzylidene]-thiazolidine-2,4-dione compounds of general formula (I), their pharmaceutically acceptable salts, solvates their synthesis and uses thereof, in pharmaceutical compositions containing compounds and to the use of such compounds and composition in medicines either alone or in combination with other compounds.

WO 2019/016826 A1

"Novel 5-[4-(2-biphenyl-4-yl-2-oxo-ethoxy)-benzylidene]-thiazolidine-2,4-diones, their synthesis and uses thereof"

FIELD OF INVENTION:

The present invention relates to novel 5-[4-(2-biphenyl-4-yl-2-oxo-ethoxy)-benzylidene]-thiazolidine-2,4-dione compounds of general formula (I), their pharmaceutically acceptable salts, solvates their synthesis and uses thereof, to pharmaceutical compositions containing compounds and to the use of such compounds and composition in medicines either alone or in combination with other compounds.

BACKGROUND AND PRIOR ART:

Diabetes mellitus is a chronic multifactorial metabolic disease resulting from insulin deficiency or insulin resistance, characterized by elevated blood glucose level or hyperglycaemia. Diabetes is a life-long disease and there is no permanent cure. Diabetes mellitus, in the 21st century is considered to be the main threat to human health [Thareja, S.; Aggarwal, S.; Bhardwaj, T. R.; Kumar, M. Protein tyrosine phosphatase 1B inhibitors: a molecular level legitimate approach for the management of diabetes mellitus. *Med. Res. Rev.* **2012**, *32*, 459-517; Zimmet, P., Alberti, K. G., Shaw, J. Global and societal implications of the diabetes epidemic. *Nature* **2001**, *414*, 782-787; Schwarz, J., Bornstein, S. R., Schulze, J. Prevention of type 2 diabetes: what challenges do we have to address? *J. Public Health* **2005**, *13*, 303-308]. Globally, diabetes has shadowed the spread of 'modern lifestyle' and can be linked to an increasingly overweight and sedentary population [Vats, R. K.; Kumar, V.; Kothari, A. Emerging targets for diabetes mellitus. *Curr. Sci.* **2005**, *88*, 241-249]. The prevalence of diabetes worldwide was 285 million in the year 2010, present data shows 387 million people worldwide have diabetes in the year 2014, and it is estimated that it will reach 592 million by the year 2035 [Verma, S. K.; Thareja, S. Molecular docking assisted 3D-QSAR study of benzylidene-2, 4-thiazolidinedione derivatives as PTP 1B inhibitors for the management of Type-2 diabetes mellitus. *RSC Adv.* **2016**, *6*, 33857-33867]. Diabetes is threatening on

account of development of many severe complications namely cardiac abnormalities, atherosclerosis, microangiopathy, nephropathy, neuropathy, retinopathy and cataracts [Chung, S. S.; Chung, S. K. Aldose reductase in diabetic microvascular complications. *Curr. Drug Targets* 2005, 6, 475-486; Suzen, S.; Buyukbingol, E. Recent studies of aldose reductase enzyme inhibition for diabetic complications. *Curr. Med. Chem.* 2003, 10, 1329-1352]. Protein tyrosine phosphatase 1B (PTP 1B) is a ubiquitously expressed intracellular enzyme which causes negative regulation of insulin receptor as well as leptin signaling system emerged as a potential target for the management of type 2 diabetes [Lund, I. K.; Bilestun, N. Mechanism of PTP 1B mediated inhibition of leptin signaling. *J. Mol. End.* 2005, 15, 339-351; Forseil, P. A. L.; Boie, Y.; Montalibet, J.; Collins, S.; Kennedy, B. P. Genomic characterization of the human and mouse protein tyrosine phosphatase-1B genes. *Gene* 2000, 260, 145-153]. It has been involved in down-regulation of receptor tyrosine kinase activity following stimulation of the insulin or leptin receptors [Kennedy, B. P.; Ramachandran, C. Protein tyrosine phosphatase 1B in diabetes. *Biochem. Pharmacol.* 2000, 60, 877- 883; Byon, J. C.; Kusari, J.; Kusari, A. B. Protein tyrosine phosphatase 1B acts as a negative regulator of insulin signal transduction. *Mol. Cell. Biochem.* 1998, 182, 101-108]. Various studies on PTP 1B knockout mice provided significant support for the view that PTP 1B is a key regulator of insulin signalling [Elchebly, M.; Payette, P.; Michaliszyn, E.; Cromlish, W.; Collins, S.; Loy, A. L. Increased insulin sensitivity and obesity resistance in mice lacking the protein tyrosine phosphatase-1B gene. *Science* 1999, 283, 1544-1548]. Therefore, PTP 1B inhibitors could potentially ameliorate insulin resistance and normalize plasma glucose and insulin levels without inducing hypoglycemia, and could, therefore, be a major advancement in the treatment of T2DM [Zhang, Z. Y.; Lee, S. Y. PTP 1B inhibitors as potential therapeutics in the treatment of Type 2 diabetes. *Expert Opin. Invest. Drugs* 2003, 12, 223-233; Sachan, N.; Thareja, S.; Aggarwal, R.; Kadam, S. S.; Kulkarni, V. M. Substituted biphenyl ethanones as antidiabetic agents: synthesis and *in-vivo* screening. *Int. J. Pharm Tech Res.* 2009, 1, 1625-1631].

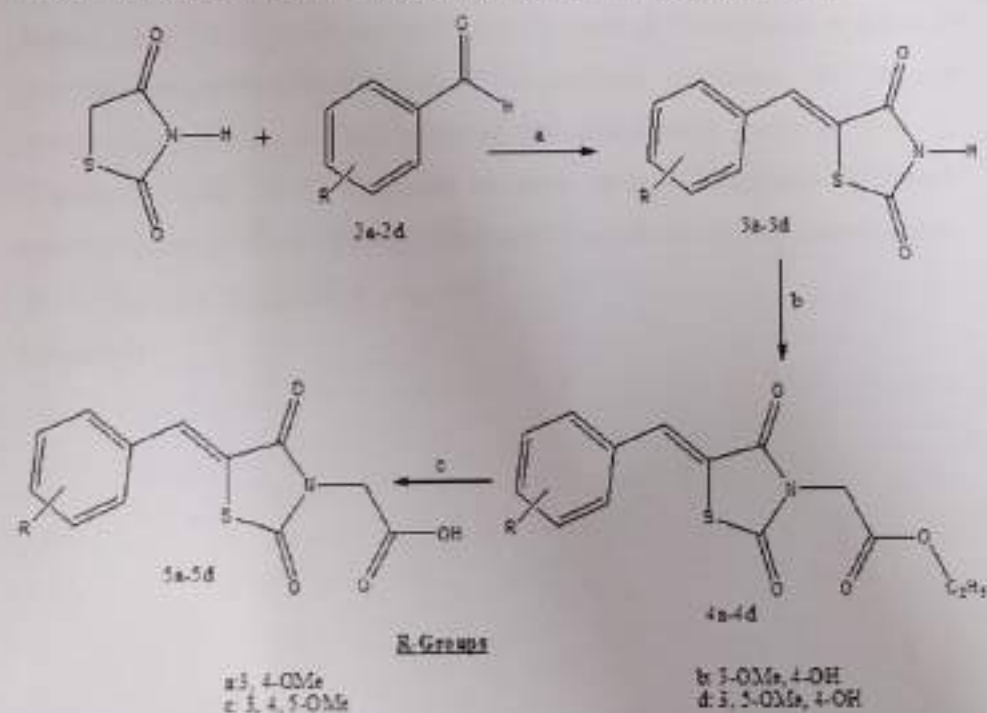
Thiazolidine-2,4-dione is an important heterocyclic system that exhibit a range of pharmacological activities such as anti-hyperglycemic, anti-inflammatory, anti-cancer, anti-microbial among others. The broad spectrum of pharmacological activity is due to the analogues obtained by substitution at free -NH and methylene group in the thiazolidine-2,4-dione moiety. The structural variation at the said free ends of thiazolidine-2,4-dione moiety has led to the development of biologically active molecules against a broad spectrum of protein targets, but not limited to, such as Peroxisome Proliferator activated receptor (PPAR γ), Aldose reductase (ALR2), Cyclooxygenase (COX-2) and PTP 1B.

Thiazolidinediones (TZDs) which are oral insulin-sensitizing agents act by indirectly enhancing peripheral insulin sensitivity, thereby lowering the levels of both glucose and insulin [Bhattarai, B. R.; Kafle, B.; Hwang, J. S.; Khadka, D.; Lee, S. M.; Kang, J. S.; Ham, S. W.; Han, I. O.; Park, H.; Cho, H. Thiazolidinedione derivatives as PTP 1B inhibitors with antihyperglycemic and antiobesity effects. *Bioorg. Med. Chem. Lett.* **2009**, *19*, 6161-6165]. A major benefit of the thiazolidinediones is that unlike sulfonylurea derivatives, α -glucosidase inhibitors, or insulin, they influence insulin resistance. Of the thiazolidinedione compounds, ciglitazone, troglitazone, englitazone, pioglitazone, and rosiglitazone have been clinically examined as potential antidiabetic compounds but all are suffering from various side effects thus withdrawn (except Pioglitazone) from the market [Maccari, R.; Paoli, P.; Ottanà, R.; Jacomelli, M.; Ciurleo, R.; Manao, G.; Steindl, T.; Langer, T.; Vigorita, M. G.; Camici, G. 5-Arylidene-2,4-thiazolidinediones as inhibitors of protein tyrosine phosphatases. *Bioorg. Med. Chem.* **2007**, *15*, 5137-5149]. Pioglitazone is the only TZD available for clinical use in the management of T2DM. There has been speculation that the toxicity observed with the thiazolidinedione class of molecules is due to its binding to peroxisome proliferator activator receptor (PPAR) belonging to the steroid/ thyroid/retinoid receptor super family of ligand-activated transcription factors [Lohray, B. B.; Bhushan, V.; Reddy, A. S.; Rao, P. B.; Reddy, N. J.; Harikishore, P.; Haritha, N.; Vikramadityan, R. K.; Chakrabarti, R.; Rajagopalan, R.; Katmeni, K. Novel euglycemic and

hypolipidemic agents: pyridyl and quinoliny containing thiazolidinediones. *J. Med. Chem.* 1999, 42, 2569-2581]. Development of an orally bioavailable and specific PTP 1B inhibitors is not an easy task due to poor cell permeability of the small molecules exhibiting high affinity with PTP 1B due to their hydrophilic nature. A first-in-class PTP 1B inhibitor has yet to be discovered; however, extensive research is under way to develop a potential blockbuster drug.

There are various patented and non-patented literature disclosing Thiazolidine-2,4-dione compounds and their synthesis, few of them are referred below.

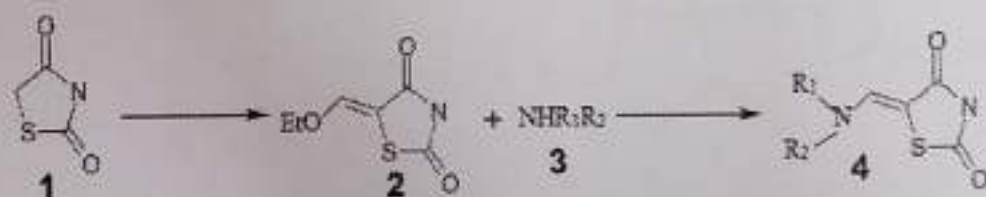
Article titled "Design and synthesis of novel thiazolidine-2,4-diones as hypoglycemic agents" by P. Datar *et al.* published in *J. Saudi Chem. Soc.* 2016, 20, S196-S201 disclose Thiazolidine-2,4-diones derivatives having carboxylic ester appendages at N-3 and 5-substituted benzylidene for treatment in diabetes. The synthesis of compounds disclosed in said article is as shown below:



Scheme Reagents: (a) Piperidine, Ethanol, CH₃-COOH; (b) NaH, Ethyl bromoacetate, Dry DMF; (c) Conc. HCl, Glacial acetic acid.

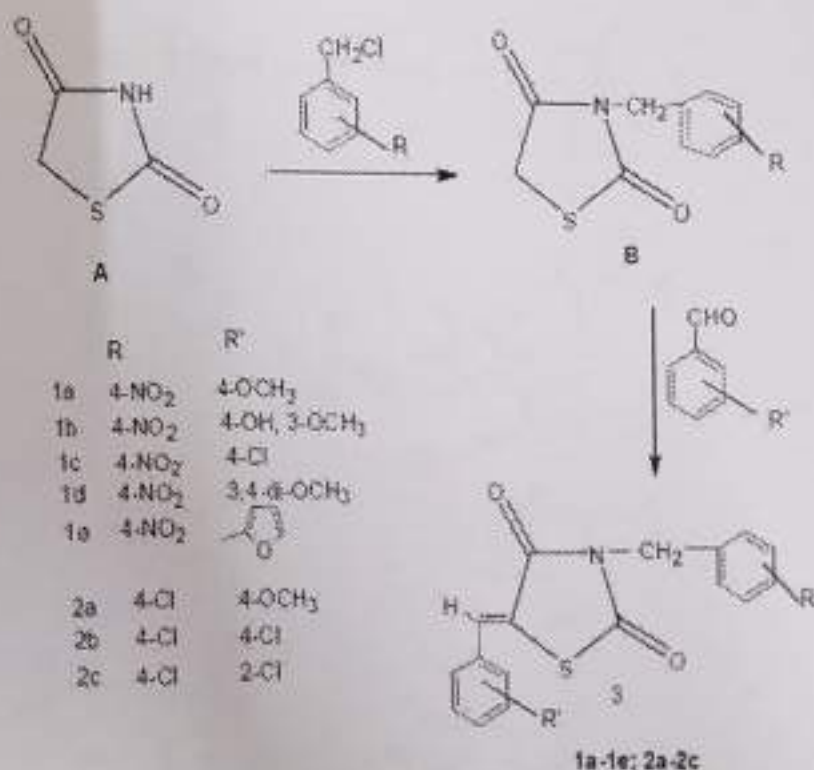
Article titled "Design and synthesis of a novel 5-(aminomethylene)thiazolidine-2,4-dione derivatives as potent hepatitis-B virus polymerase inhibitors" by Wei-Guo Li in *Bangladesh J. Pharmacol.* **2015**, *10*, 271-78 reported a series of substituted 5-(aminomethylene)thiazolidine-2,4-diones. The synthetic procedure (**Scheme 1**) comprises of reaction of thiazolidine-2,4-dione (**1**) with triethyl orthoformate in the presence of Ac_2O at reflux temperature to obtain 5-(ethoxymethylene)thiazolidine-2,4-dione (**2**) followed by condensation with various secondary amines in ethanol at reflux temperature to afford substituted 5-(aminomethylene)thiazolidine-2,4-diones (**4**) as shown in Table 1 of said article.

Scheme 1:

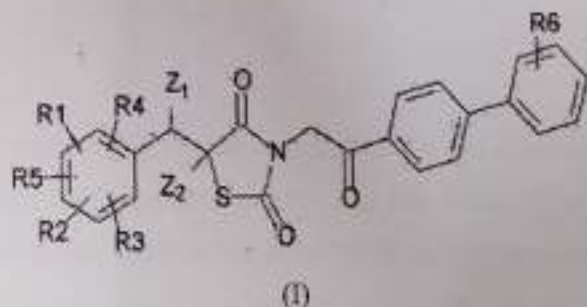


Ankush Garg *et al.* reported the synthesis of a series of 5-substituted-arylidene-3-substitutedbenzyl-thiazolidine-2,4-dione derivatives (**Scheme 2**) through Knoevenagel condensation and evaluated their anti-diabetic potential [Garg, A.; Chawla, P.; Saraf, S. A. Syntheses of some novel 5-Substituted-arylidene-3-substituted-benzyl-thiazolidine-2,4-dione analogues as anti-hyperglycemic agents. *Int. J. Drug Dev. Res.* **2012**, *4*, 141-146].

Scheme 2:



WO2010082212 discloses N-Biphenylacetyl-thiazolidine-2,4-dione derivatives of general formula (I).



wherein the variables R₁ to R₆, Z₁ and Z₂ are as described. The compounds of general formula (I) are used in the treatment of hyperglycemia, hypertension, PTP 1B inhibition, insulin resistance and exhibit anti-cancer activity. The general synthesis of said derivatives of formula (I) is shown below:

Scheme 3:

Protein Tyrosine Phosphatase 1B with Antihyperglycemic Properties. *J. Med. Chem.* **2000**, *43*, 1293-1310; Murthy, V. S.; Kulkarni, V. M. 3D-QSAR CoMFA and CoMSIA on protein tyrosine phosphatase 1B inhibitors. *Bioorg. Med. Chem.* **2002**, *10*, 2267-2282; Ahn, J. H.; Cho, S. Y.; Ha, J. D.; Chu, S. Y.; Jung, S. H.; Jung, Y. S.; Baek, J. Y.; Choi, I. K.; Shin, E. Y.; Kang, S. K.; Kim, S. S.; Cheon, H. G.; Yang, S. D.; Choi, J. K. Synthesis and PTP1B inhibition of 1, 2-naphthoquinone derivatives as potent anti-diabetic agents. *Bioorg. Med. Chem. Lett.* **2002**, *12*, 1941-1946; Shim, Y. S.; Kim, K. C.; Chi, D. Y.; Lee, K. H.; Cho, H. Formylchromone derivatives as a novel class of protein tyrosine phosphatase 1B inhibitors. *Bioorg. Med. Chem. Lett.* **2003**, *13*, 2561-2563; Arabaci, G.; Yi, T.; Fu, H.; Porter, M. E.; Beebe, K. D.; Pei, D. α -Bromoacetophenone derivatives as neutral protein tyrosine phosphatase inhibitors: structure-Activity relationship. *Bioorg. Med. Chem. Lett.* **2002**, *12*, 3047-3050; Guertin, K. R.; Setti, L.; Qi, L.; Dunsdon, R. M.; Dymock, B. W.; Jones, P. S.; Overton, H.; Taylor, M.; Williams, G.; Sergi, J. A.; Wang, K.; Peng, Y.; Renzetti, M.; Boyce, R.; Falcioni, F.; Garippa, R.; Olivier, A. R. Identification of a novel class of orally active pyrimido[5,4-3][1,2,4]triazine-5,7-diamine-based hypoglycemic agents with protein tyrosine phosphatase inhibitory activity. *Bioorg. Med. Chem. Lett.* **2003**, *13*, 2895-2898]. Molecular modeling studies on PTP 1B with biphenyl derivatives have also suggested that active site of PTP 1B is highly hydrophobic and biphenyl moiety is favourable due to its favourable interaction with hydrophobic residues of PTP 1B [Murthy, V.S., Kulkarni, V.M. Molecular modelling of protein tyrosine phosphatases 1B (PTP 1B) Inhibitors. *Bioorg. Med. Chem.* **2002**, *10*, 897-906]. It also provides sufficient lipophilicity to cross intracellular barrier and active against intracellular targets such as PTP 1B [Tam, S.; Saiah, E. Recent advances in the discovery and development of PTP 1B inhibitors. *Drugs Future* **2008**, *133*, 175-185].

Recently, it has been also reported that arylidene-2,4-TZD derivatives with N-substitution are of particular interest as PTP 1B enzyme inhibitors making them devoid of side effects associated with glitazones [Maccari, R.; Paoli, P.; Ottana, R.; Jacomelli, M.; Ciurleo, R.; Manao, G.; Steindl, T.; Langer, T.; Vigorita, M. G.;

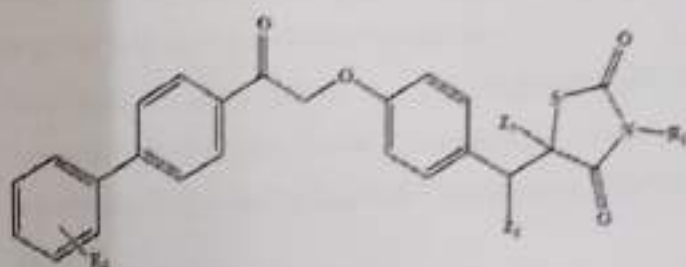
Camici, G. 5-Arylidene-2,4-thiazolidinediones as inhibitors of protein tyrosine phosphatases. *Bioorg. Med. Chem.* **2007**, *15*, 5137-5149; Maccari, R.; Ottana, R.; Ciurleo, R.; Paoli, P.; Manao, G.; Camici, G.; Laggner, C.; Langer, T. Structure-Based Optimization of Benzoic Acids as Inhibitors of Protein Tyrosine Phosphatase 1B and Low Molecular Weight Protein Tyrosine Phosphatase. *Chem. Med. Chem.* **2009**, *4*, 957-962; Ottana, R.; Maccari, R.; Ciurleo, R.; Paoli, P.; Jacomelli, M.; Manao, G.; Camici, G.; Laggner, C.; Langer, T. 5-Arylidene-2-phenylimino-4-thiazolidinones as PTP 1B and LMW-PTP inhibitors. *Bioorg. Med. Chem.* **2009**, *17*, 1928-1937].

The present inventors felt that there exists a scope to develop novel series of thiazolidine-2, 4-dione over the art having potential activity for treatment of diabetes. The present invention provides novel series of 5-[4-(2-biphenyl-4-yl-2-oxo-ethoxy)-benzylidene]-thiazolidine-2,4-dione compounds with N-substitution at thiazolidine ring which can be used in pharmaceutical compositions for efficient treatment of diabetes and having broad spectrum of activity against various protein targets, but not limited to, such as Peroxisome Proliferator activated receptor (PPAR γ), Aldose reductase (ALR2), Cyclooxygenase (COX-2), Protein tyrosine phosphatase 1B (PTP 1B).

SUMMARY OF THE INVENTION

One of the objective of the present invention is to provide novel series of 5-[4-(2-biphenyl-4-yl-2-oxo-ethoxy)-benzylidene]-thiazolidine-2,4-diones with N-substitution at TZD ring, their synthesis pharmaceutical compositions thereof having antidiabetic activities.

In accordance with the above, the present invention provides library of 5-[4-(2-biphenyl-4-yl-2-oxo-ethoxy)-benzylidene]-thiazolidine-2,4-dione compounds of general formula (I) or its pharmaceutically acceptable salts, solvates, isomers, enantiomers thereof;



(I)

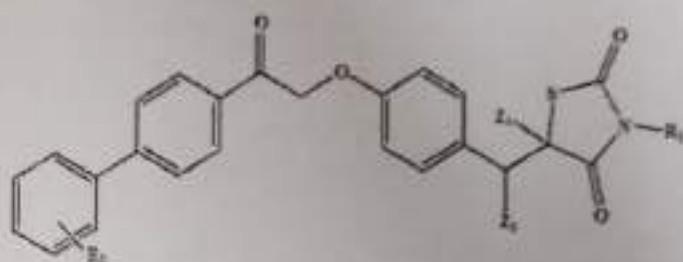
wherein;

R_1 is independently selected from hydrogen, (un)-substituted or substituted linear or branched alkyl, ketones, acids, esters or alkoxy, (un)-substituted or substituted aryl or (un)-substituted or substituted alkylaryl;

R_2 is independently selected from hydrogen, (un)-substituted or substituted linear or branched alkyl, -CN, -SO₃H, (un)-substituted or substituted amines or acids;

Z_1 and Z_2 independently represent hydrogen or together form a chemical bond.

In another aspect, the present invention provides a process for synthesis of library of 5-[4-(2-biphenyl-4-yl-2-oxo-ethoxy)-benzylidene]-thiazolidine-2,4-dione compounds of general formula (I);



(I)

wherein;

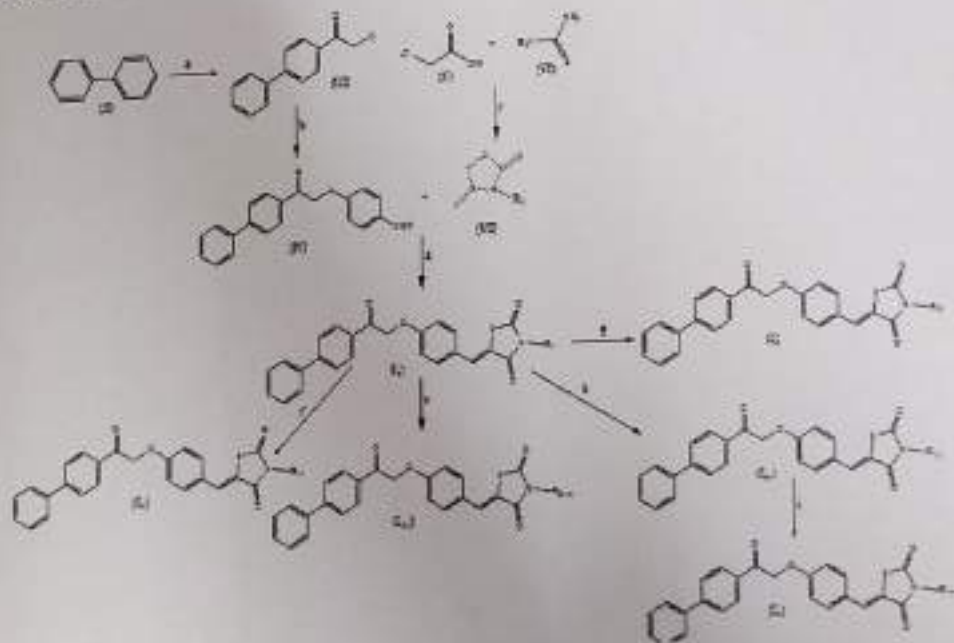
R_1 is independently selected from hydrogen, (un)-substituted or substituted linear or branched alkyl, ketones, acids, esters or alkoxy, (un)-substituted or substituted aryl or (un)-substituted or substituted alkylaryl;

R_2 is independently selected from hydrogen, (un)-substituted or substituted linear or branched alkyl, -CN, -SO₃H, (un)-substituted or substituted amines or acids;

Z₁ and Z₂ independently represent hydrogen or together form a chemical bond, which comprises at least one of the following reactions;

- (i) Knoevenagel condensation of 4-(2-Biphenyl-4-yl-2-oxo-ethoxy)-benzaldehyde of formula (IV) with thiazolidine-2,4 dione (VII) to obtain 5-[4-(2-biphenyl-4-yl-2-oxo-ethoxy)-benzylidene]-thiazolidine-2,4-dione (I_a),
- (ii) N-alkylation of 5-[4-(2-biphenyl-4-yl-2-oxo-ethoxy)-benzylidene]-thiazolidine-2,4-dione (I_a) in presence of base and solvent to obtain compounds (I_b), (I_c) and (I_d), or
- (iii) N-acylation of 5-[4-(2-biphenyl-4-yl-2-oxo-ethoxy)-benzylidene]-thiazolidine-2,4-dione (I_a) in presence of base and solvent to obtain compounds (I_e),
- (iv) Acid hydrolysis of compound (I_m) of step (ii) to yield compound (I_a).

The process is shown in **Scheme 4** below.



In another aspect, the compounds of formula (I) of the present invention comprise,

1. (Z)-5-[4-(2-Biphenyl-4-yl-2-oxo-ethoxy)-benzylidene]-thiazolidine-2,4-dione (I_a);



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Dated: 2/12/22

To

Dr. Yashwant Dev Panwar
Head
Patent Facilitation Centre
Technology Information, Forecasting & Assessment Council (TIFAC)
Department of Science & Technology, Vishwakarma Bhawan, A-Wing
Shaheed Jeet Singh Marg, New Delhi-110016

Sub: Patent Application titled "Synthesis and Evaluation of Polyphosphazene-linked prodrugs of 5-fluorouracil for targeted treatment of colon cancer"

Sir,

This has reference to a patent application received by this office on the subject cited above. In this context, preliminary patent search by using freely available patent database has been conducted by HP Patent Information Centre. This office is forwarding the above mentioned patent application for further financial grant and filing with Patent Office, Gol.

The patent search report is enclosed for further reference. Your good self is requested to do the needful for patenting the above invention.

Thanking You
Ensd: As above

Yours sincerely,

(Sat Pal Dhiman)

Joint Member Secretary

Copy for Information to:-

1. Tilak Raj Bhardwal, School of Pharmacy and Emerging Sciences, Baddi University of Emerging Sciences & Technology, Baddi, Distt. Solan-173205
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Application Filing Receipt

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e-mail: delhi-patent@nic.in

CBR Number : 44209

CBR date: 15-11-2022

Application Type: ORDINARY APPLICATION
Priority Number:
Priority Date:
Priority Country: Not Selected

To,
Tilak Raj Bhardwaj
Baddi University of Emerging Sciences & Technology Makhanumajra Baddi, Himachal Pradesh 173205

Received documents purporting to be an application for patent numbered 202211065268 dated 15-11-2022 by Tilak Raj Bhardwaj of School of Pharmacy & Emerging Sciences Baddi University of Emerging Sciences & Technology Baddi (Solan) Himachal Pradesh Pin code 173 205 relating to SYNTHESIS AND EVALUATION OF POLYPHOSPHAZENE-LINKED PRODRUGS OF 5-FLUOROURACIL FOR TARGETED TREATMENT OF COLON CANCER together with the Provisional and fee(s) of ₹1600 (One Thousand Six Hundred only).

Note:

1. In case of Patent Application accompanied by a Provisional Specification, a complete Specification should be filed within 12 months from the date of filing of the Provisional Specification, failing which the application will be deemed to be abandoned under Section 9(1) of the Patent Act, 1970.
2. You may withdraw the application at any time before the grant of patent, if you wish so. If, in addition to withdrawal, you also wish to prevent the publication of application in the Patent Office Journal, the application should be withdrawn within three months from the date of priority or date of filing, whichever is earlier.
3. If not withdrawn, your application will be published in the Patent Office Journal after eighteen months from the date of priority or date of filing, whichever is earlier.
4. If you wish to get your application examined, you should file a request for examination in Form-18 within 48 months from the date of priority or date of filing, whichever is earlier, failing which the application will be treated as withdrawn by the applicant under Section 11(8)(4) of the Patent Act, 1970.

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Docket No 127376

Date/Time 2022/11/15 11:18:58

To
Tilak Raj Bhardwaj

UserId: Bhardwajr

School of Pharmacy & Emerging Sciences
Bardoli University of Emerging Sciences &
Technology Bardoli (Solam) Himachal Pradesh
Pin code 173 205

CBR Detail:

Sr. No.	Ref. No./Application No.	App. Number	Amount Paid	C.B.R. No.	Form Name	Remarks
1	202211065268	TEMP/E-1/75258/2022-DEL	1600	44289	FORM 1	SYNTHESIS AND EVALUATION OF POLYPHOSPHAZENE-LINKED PRODRUGS OF 5-FLUOROURACIL FOR TARGETED TREATMENT

TransactionID	Payment Mode	Transaction Identification Number	Amount Paid	Head of A/C No
N-6961852394	Online Bank Transfer	1511220064927	1600.00	1475001020000001

Total Amount : ₹ 1600.00

Amount in Words: Rupees One Thousand Six Hundred Only

Received from Tilak Raj Bhardwaj the sum of ₹ 1600.00 on account of Payment of fee for above mentioned Application/Forms.

* This is a computer generated receipt, hence no signature required.

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FORM 1
THE PATENTS ACT 1970
(39 OF 1970)
&
The Patents Rules, 2003
APPLICATION FOR GRANT OF PATENT
(See section 7,54 & 135 and rule 20 (1))

(FOR OFFICE USE ONLY)

Application No.:
 Filing Date:
 Amount of Fee Paid:
 CBR No.:

Signature:

1. APPLICANT'S REFERENCE /IDENTIFICATION NO.
(AS ALLOTTED BY OFFICE)

2. TYPE OF APPLICATION [Please tick (✓) at the appropriate category]

Ordinary (✓)		Convention ()		PCT-NP ()	
Divisional ()	Patent of Addition ()	Divisional ()	Patent of Addition ()	Divisional ()	Patent of Addition ()

3A. APPLICANT (S)

Name	Nationality	Country of Residence	Address
BADDI UNIVERSITY OF EMERGING SCIENCES & TECHNOLOGY	INDIAN	INDIA	Makhanumajra, Baddi, Himachal Pradesh, India-173205

3B. CATEGORY OF APPLICANT [Please tick (✓) at the appropriate Category]

Natural Person ()	Other than Natural Person		
	Small Entity ()	Startup ()	Others (✓)

4. INVENTOR (S) [Please tick (✓) at the appropriate Category]

Are all the inventor(s) same as the applicant(s) named above? Yes () No (✓)

IF "No", furnish the details of the inventor(s)

4. INVENTOR (S)

Name	Nationality	Country of Residence	Address	
TILAK RAJ BHARDWAJ	Indian	India	Lab	Baddi University of Emerging Sciences & Technology
			Street	Makhanumajra
			State	Baddi, Himachal Pradesh
			Pin	173205
TEJVIR SINGH	Indian	India	Lab	Baddi University of Emerging Sciences & Technology
			Street	Makhanumajra
			State	Baddi, Himachal Pradesh
			Pin	173205

Signature Not Verified

Digitally Signed
 Name: Tilak Raj Bhardwaj
 Date: 15-Nov-2022 11:12:28
 Reason: Patented

ANDEEP KUMAR

Indian

India

Lab

Baddi University of Emerging
Sciences & Technology

Street

Makhanumajra

State

Baddi, Himachal Pradesh

Pin

173205

TITLE OF THE INVENTION:

SYNTHESIS AND EVALUATION OF POLYPHOSPHAZENE-LINKED PRODRUGS OF 5-
FLUOROURACIL FOR TARGETED TREATMENT OF COLON CANCER

AUTHORISED REGISTERED PATENT AGENT(S)

**ADDRESS FOR CORRESPONDENCE OF
APPLICANT / AUTHORIZED PATENT AGENT IN INDIA**

Telephone No. :

Fax No.

Mobile No.



Intellectual
Property
Office

Certificate of Registration for a UK Design

Design number: 6305723

Grant date: 05 September 2023

Registration date: 25 August 2023

This is to certify that,

in pursuance of and subject to the provision of Registered Designs Act 1949, the design of which a representation or specimen is attached, had been registered as of the date of registration shown above in the name of

Dr. Adarsh Sahu, Jyotika Mishra, Rituparna Palit, Chavan Bhagwat Babasaheb,

Dr. Arun Kumar, Bommaiah Prakash Kumar, Huma Sulthana, Dr. Anjali Ganjare,

Dr. Natarajan Kiruthiga, Dr. Ravinesh Mishra

in respect of the application of such design to:

Portable Device for Purification of Semisynthetic Derivatives

International Design Classification:

Version: 14-2023

Class: 24 MEDICAL AND LABORATORY EQUIPMENT

Subclass: 02 MEDICAL INSTRUMENTS, INSTRUMENTS AND TOOLS FOR LABORATORY USE

Adam Williams

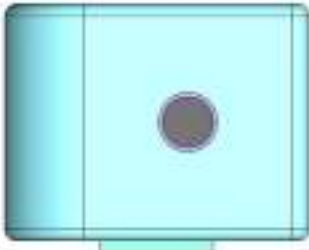
Comptroller-General of Patents, Designs and Trade Marks

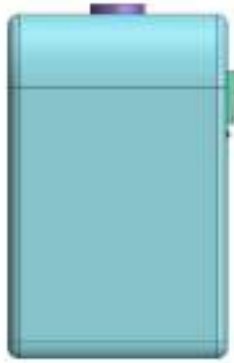
Intellectual Property Office

The attention of the Proprietor(s) is drawn to the important notes overleaf.

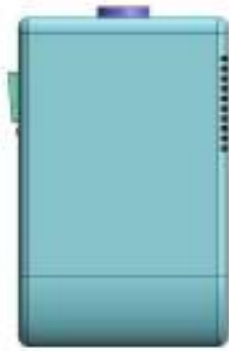


Representation of Designs









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