Memorandum of Understanding

Between

Dr. Devidas S. Bhagat
Assistant Professor,
Department of Forensic Chemistry,
Government Institute of Forensic Science,
Aurangabad 431 004,
MS, INDIA.

Dr. Gurvinder S. Bumbrah
Assistant Professor,
Department of Chemistry, Biochemistry and Forensic Science, Amity School of Applied Sciences, Amity University,
Gurugram 122 413. Haryana, India.

Memorandum of Understanding is signed with the mutual agreement of both the representatives of institutes as per:

Article 1:

The subject at present Memorandum of Understanding is the establishment of an educational cooperation between Dr. Devidas S Bhagat, Assistant Professor, Department of Forensic Chemistry, Government Institute of Forensic Science, Aurangabad 431 004, and Dr. Gurvinder S. Bumbrah, Assistant Professor, Department of Chemistry, Biochemistry and Forensic Science, Amity School of Applied Sciences, Amity Education Valley, Amity University, Gurugram (Manesar), Haryana, India..

Article 2:

Following terms and conditions agreed upon by both the parties agreed to endeavor to cooperate

1. To undertake collaborative research activities leading to research analysis.
2. To work in collaboration leading to research findings and subsequent publication.
3. To accomplish joint academic and research related activities
4. To work jointly on particular research areas for research projects, etc.
5. There will be no financial obligations/liabilities on both institutions.

Article 3:

The present MoU is intended for the next five years from **06 March 2020.**

Dr. D. S. Bhagat
Assistant Professor

Dr. D. S. Bhagat
Assistant Professor, Class-I Gazetted
Government Institute of Forensic Science,
Aurangabad - 431 004.

Dr. G. S. Bumbrah
Assistant Professor

Govt. Institute of Forensic Science Aurangabad सत्यमेव जयते

Amity School of Applied Sciences (ASAS) Amity University Haryana (AUH) Gurgaon-122413 (INDIA)

Director
Govt. Institute of Forensic Science
Aurangabad.

Date: 12/5/23

TO WHOM IT MAY CONCERN

This is to certify, that there have been collaborative research activities between faculty members of ***Government Institute of Forensic Science, Nipatniranjan Nagar, Caves Road, Aurangabad-431004*** and ***Amity School of Applied Sciences, Amity Education Valley, Amity University, Gurugram (Manesar), Haryana, India***. The details of the collaborative research activities carried out are as follows:

Collaborators:

1. Dr. Gurvinder S. Bumbrah, Assistant Professor, Department of Chemistry, Biochemistry and Forensic Science, Amity School of Applied Sciences, Amity Education Valley, Amity University, Gurugram (Manesar), Haryana, India.

Between

2. Dr. Devidas S. Bhagat, Assistant Professor, Department of Forensic Chemistry, Government Institute of Forensic Science, Nipatniranjan Nagar, Caves Road, Aurangabad-431004, MS, India.

It is hence certified that there have been successful collaboration in term of research and resulted in the research paper publication during ***2019-20*** to ***2021-22.***

No. of Publications: **08**

Dr. Devidas S. Bhagat
Assistant Professor,

Dr. D. S. Bhagat
Assistant Professor, Class-I Gazetted
Government Institute of Forensic Science,
Aurangabad - 431 004.

12/5/23

Dr. Gurvinder S. Bumbrah
Assistant Professor

Amity School of Applied Sciences
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Amity University Haryana

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Aurangabad

Director
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Aurangabad.

Following are the list of the publications

Academic Year 2020-21

1. Bhagat, Devidas S., Pooja A. Chawla, Wasudeo B. Gurnule, Sampada K. Shejul, and Gurvinder S. Bumbrah. "An insight into synthesis and anticancer potential of thiazole and 4-thiazolidinone containing motifs." Current Organic Chemistry 25, no. 7 (2021): 819-841.
   https://doi.org/10.2174/1385272825999210101234704
2. Bhagat, Devidas S., Gurvinder S. Bumbrah, Pooja A. Chawla, Wasudeo B. Gurnule, and Sampada K. Shejul. "Recent Advances in Synthesis and Anticancer Potential of Triazole-Containing Scaffolds." Anti-Cancer Agents in Medicinal Chemistry (Formerly Current Medicinal Chemistry-Anti-Cancer Agents) 22, no. 16 (2022): 2852-2875.
   https://doi.org/10.2174/1871520622666220217161346
3. Bhagat, Devidas S., Ranjitsingh K. Nimbalkar, Sampada K. Shejul, Wasudeo B. Gurnule, Aparna B. Gunjal, and Gurvinder S. Bumbrah. "An Insight into Ayurveda and Yogic Practices Sustain Physical and Mental Health in COVID-19 Pandemic." (2021).
   https://doi.org/10.33263/BRIAC104.29182932
4. Bumbrah, Gurvinder Singh, Mithlesh Jani, Devidas S. Bhagat, Komal Dalal, Akshey Kaushal, K. Sadhana, G. Sriramulu, and Anirban Das. "Zinc oxide nanoparticles for detection of latent fingermarks on nonporous surfaces." Materials Chemistry and Physics 278 (2022): 125660.
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5. Kumar, Sachin, Devidas Sudam Bhagat, and Gurvinder Singh Bumbrah. "1, 2-Indanedione (IND) Reagent for The Detection of Latent Fingermarks: A Review." Arab Journal of Forensic Sciences & Forensic Medicine 3, no. 1 (2021): 77-93. doi: 10.26735/NRYD9355

Academic Year 2021-22

6. Bhagat, Devidas S., Gurvinder S. Bumbrah, and Wasudeo B. Gurnule. "Rare Earth Element Based Functionalized Electrocatalysts in Overall Water Splitting Reactions." In Metal Nanocomposites for Energy and Environmental Applications, pp. 205-218. Springer, Singapore, 2022.
https://link.springer.com/chapter/10.1007/978-981-16-8599-6_9
7. Bhagat, Devidas S., Wasudeo B. Gurnule, Gurvinder S. Bumbrah, Pankaj Koinkar, and Pooja A. Chawla. "Recent Advances in Biomedical Applications of Biogenic Nanomaterials." Current Pharmaceutical Biotechnology (2022).
https://doi.org/10.2174/1389201023666220513101628
8. Sanskruti C Raje, Devidas S Bhagat, Ranjitsingh K Nimbalkar, Sampada K Shejul, Gurvinder Singh Bumbrah, Mahipal Singh Sankhla, Contributions and Current Trends of Forensic Botany in Crime Scene Investigation, Forensic Science Journal, 2022;21(1):1-12, DOI:10.6593/FSJ.202212_21(1).0001

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Anti-Cancer Agents in Medicinal Chemistry, 2022, *22*, 1-7

REVIEW ARTICLE

Recent Advances in Synthesis and Anticancer Potential of Triazole-containing Scaffolds

Devidas S. Bhagat[1,*], Gurvinder S. Bumbrah[2], Pooja A Chawla[3,*], Wasudeo B. Gurnule[4] and Sampada K. Shejul[5]

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Abstract: Cancer is the most lethal disease that may be found anywhere globally. Approximately 10% of individuals die due to cancer of various types, with 19.3 million new cancer cases and 10 million deaths reported in 2020. More than 100 medications are commercially available for the treatment of cancer, but only a few candidates have high specificity, resulting in several side effects. The scientific community has spent the past decades focusing on drug discovery. Natural resources are used to isolate pharmaceutically active candidates, which are then synthesized in laboratories. More than 60% of all prescribed drugs are made from natural ingredients. Unique five-membered heteroaromatic center motifs with sulfur, oxygen and nitrogen atoms are found in heterocyclic compounds, such as indazole, thiazole, triazole, triazole, and oxazole, and are used as a core scaffold in many medicinally important therapies. Triazole possesses a wide range of pharmacological activities, including anticancer, antibacterial, antifungal, antibiotic, antiviral, analgesic, anti-inflammatory, anti-HIV, antidiabetic, and antiprotozoal activities. Novel triazole motifs with a variety of biological characteristics have been successfully synthesized using versatile synthetic methods. We intend here to facilitate the rational design and development of innovative triazole-based anti-cancer medicines with increased selectivity for various cancer cell lines by providing insight into various ligand-receptor interactions.

Keywords: 1, 2, 3-triazole, 1, 2, 4-triazole, anticancer activity, drug discovery, synthesis, pharmacological activities.

1. INTRODUCTION

Several research groups have been working on the design of biologically active motifs in which five-member nitrogen-containing heterocycles possess great significance in medicinal chemistry and new drug design. The triazoles are the prominent heterocyclic motifs containing five-membered ring that exists in two isomeric forms, including 1,2,3-triazole (**1**) and 1,2,4-triazole (**2**) [2]. Triazoles have been associated with several biological activities, including anticancer activity (**3**) and anti-HIV activity (**4**) [1-2]. Medicinally important triazole-containing scaffolds are in great demand for the development of new therapeutics [3].

Nowadays, many triazole-containing candidates are clinically approved and used in routine practice [4]. Itraconazole (**5**) is clinically used as an antifungal agent. These candidates effectively inhibit the proliferation of human umbilical vein endothelial cells *in vitro* [5]. Voriconazole (**6**) is a diastereoselective antifungal drug obtained by the condensation reaction of the substituted pyridine derivatives and triazole [6]; not only this, but triazole is also a building block of the ribavirin (**7**) (antiviral drugs), with proven anti RNA viral activity. Mubritinib (**8**), a clinically tested anticancer drug possesses a triazole motif in its structure, and it is used for the treatment of acute myeloid leukemia, breast cancer, urinary bladder cancer, and prostate cancer [7]. Tazobactam (**9**) shows antibiotic properties, made of penicillin and triazole motifs. It acts as the β-lactamase inhibitor with a broad spectrum of antibacterial activity against both gram-positive and gram-negative bacterial species [8].

Triazoles are significant pharmacophores due to their dipole forming attractiveness, rigidity, hydrogen bond forming tendency, and efficient solubility [9-11]. Triazoles exhibit a wide range of biological activity, *i.e.*, antioxidant [12], antimalarial [13], antiviral [14], anticonvulsant [15], cannabinoid CB1 receptor antagonists [16], anti-urease [17], antibacterial [18], and antifungal [19]. Fluconazole (**10**) possesses antifungal activity against *Candida albicans* [20]. Isavuconazole (**11**) exhibits broad spectrum antifungal activity [21]. Substituted triazole exhibits potential anticancer activity (**12**) [22]. Triazole is a privileged scaffold in various fields of chemistry, including supramolecular chemistry [23], acting as photo stabilizer [24], liquid crystal [25], corrosion inhibitor [26], polymer [27], agrochemical [28], photo stabilizer [29], and ligand [30].

1,2,4-triazole derivatives also possess a wide range of biological activities, including anticonvulsant, anxiolytic (estazolam **13**), a broad spectrum of antifungal potential (posaconazole **14**) [31], antimigraine (rizatriptan **15**) [32], anticancer (anastrozole **16**) [33], antiplatelet (trapidil **17**) [34], and anticonvulsant (**18** lorecelezole) [35].

2. SYNTHETIC STRATEGIES

1,2,3-triazole moiety has been focused in intense research work due to its wide range of pharmaceutical potential. In the last three decades, many researchers have worked on the development of

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Zinc oxide nanoparticles for detection of latent fingermarks on nonporous surfaces

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HIGHLIGHTS

- ZnO nanoparticles (~12.8 nm) synthesized by hydrothermal method.
- Characterized by PXRD, HRTEM, EDAX, DRS and FTIR.
- Developed latent fingermarks on dry and wet surfaces.
- Fresh and old latent fingermarks can be developed.
- Formulation is non-toxic, cost-effective and superior to previous reports.

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Latent impressions
Nanoparticles
Zinc oxide
Powder method
Non-porous surfaces

ABSTRACT

In the present study, zinc oxide (ZnO) nanoparticles were synthesized using hydrothermal method. The prepared nanoparticles were characterized by powder X-ray diffraction, transmission electron microscopy, energy dispersive X-ray spectroscopy, diffused reflectance spectroscopy and Fourier transform infrared spectroscopy. The PXRD confirms the hexagonal phase of the ZnO nanoparticles having space group P63mc and lattice parameters a = b = 3.2498 Å, c = 5.2066 Å. The obtained ZnO nanoparticles are spherical with an average size of ~12.8 nm as confirmed by TEM. XPS analysis confirms Zn to be in the +2 oxidation state. These nanoparticles were used to develop fresh and aged (24 h old) latent fingermarks on dry and moist non-porous surfaces using powder dusting method. These nanoparticles develop sharp and clear fingerprints and second level details of the fingerprints without any background noise can be viewed on glass and aluminum surfaces. The developed nanoparticles are non-hazardous and cost-effective in nature. The proposed powder formulation is a simple to prepare and can be efficiently used to develop latent fingermarks on wide range of dry and wet, smooth, non-porous surfaces recovered from scene of crime.

1. Introduction

Fingermarks are a unique identifying feature of the human beings. They are frequently used for identification purposes in civil and criminal investigations due to their uniqueness and permanency [1–3]. They are commonly found on various items recovered from the crime scenes. They are one of the oldest and universally accepted physical evidence used to identity a person and can provide a direct link to the suspect [1–3].

Fingermarks are formed by sweat residues released from pores present on friction ridge skin of fingertips. The impressions formed are usually invisible to the naked eye and, therefore, termed as latent fingermarks. Eccrine, apocrine and sebaceous glands are responsible for natural secretions from fingers. Numerous eccrine glands are present on the palms of hands. These glands produce colorless sweat. It comprises of approximately 99% water, 0.5% organic and 0.5% inorganic contents. Eccrine sweat consists of amino acids, choline, creatinine, lactic acid, proteins, sugars, urea, and uric acid while sebaceous sweat consists of

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Contributions and Current Trends of Forensic Botany in Crime Scene Investigation

Sanskruti C. Raje [1], M.Sc. ; Devidas S. Bhagat [1*], Ph.D. ; Ranjitsingh K. Nimbalkar [2], Ph.D. ; Sampada K. Shejul [3], Ph.D. ; Gurvinder Singh Bumbrah[4], Ph.D. ; Mahipal Singh Sankhla[5], Ph.D.

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Abstract

Forensic botany is the field of science that applies the knowledge, techniques, and study of plant science to legal matters. The term forensic botany proves that plants can provide forensic evidence, as various plant species occur in the environment, which is limited to specific geographic locations. Besides, every species has unique characteristics. Hence, these features make plants be useful evidence for solving criminal and civil cases. However, forensic botany remains an underutilized field in forensic casework. Furthermore, although most forensic scientists are familiar with methods for human identity testing, the use of the plant, animal, and insect evidence is yet unknown. This low knowledge is due to a lack of awareness by evidence collection teams, who do not necessarily know the importance of collecting botanical trace evidence. Therefore, this review article encompasses different sub-disciplines that come under forensic botany along with case reports and proper collection procedures of botanical evidence. Overall, this article gives the importance and applications of botanical evidence during criminal and civil case investigations.

***Keywords:** forensic botany, botanical evidence, crime scene investigation*

Introduction

The law of circumstances states that "Facts do not lie, but man can do." This law proves that every piece of evidence is important and useful while investigating a sequence of events. It also indicates that oral testimony can be influenced or changed, but the result of physical evidence along with other corroborative evidence cannot be changed, which makes a sequence of the event clear. Therefore, it is necessary to carefully collect every piece of evidence and preserve it properly. Similarly, the omnipresence of botanical evidence on the crime scene enhances its usefulness in solving criminal cases. Therefore, forensic botany is the field of science that

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Chapter 5

FORENSIC APPLICATIONS OF TITANIUM DIOXIDE NANOMATERIALS

Gurvinder Singh Bumbrah[1] and Devidas S. Bhagat[2,*]
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ABSTRACT

The term "nanotechnology" was coined by U.S. engineer Eric Drexler in the 1980s. In the past few decades, nanotechnology has found exponential growth in different fields. Nanomaterials are materials that possess at least one, and usually two dimensions with less than 100nm. It can be nanoparticles, nanowires, nanorods, nanosheets, etc. These nanomaterials have gained great attention during recent years due to their unique properties including small size, stability, and low toxicity. Titanium dioxide-based nanomaterials are regularly synthesized and used for different purposes. In this chapter, recent advances in the methods of preparation of titanium dioxide

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Arab Society for Forensic Sciences and Forensic Medicine

1,2-Indanedione (IND) Reagent for The Detection of Latent Fingermarks: A Review

استخدام كاشف 1,2-Indanedione (IND) لاكتشاف علامات الأصابع الكامنة: مراجعة علمية

Sachil Kumar[1], Devidas S. Bhagat[2], Gurvinder S. Bumbrah[3*]

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Abstract

1,2-Indanedione (IND) is a chemical which is commonly used to detect latent fingermarks on dry, porous surfaces such as paper, cardboard etc. It interacts with amino acids of latent fingermarks and develops sharp, permanent, pink (also known as Joullie pink) colored fingerprints which are fluorescent in nature. It is an efficient and non-destructive approach to develop latent fingermarks. Standardized testing and validation of IND composition is suggested to improve the efficiency of this reagent to develop latent fingermarks on a wide range of surfaces of forensic importance.

المستخلص

يعد كاشف 1,2-Indanedione (IND) مادة كيميائية تستخدم بشكل شائع للكشف عن علامات الأصابع الكامنة على الأسطح الجافة المسامية مثل الورق العادي والمقوّى وما إلى ذلك، حيث يتفاعل هذا الكاشف مع الأحماض الأمينية لعلامات الأصابع الكامنة ويشكل بصمات ملونة حادة ودائمة ووردية (Joullie pink) ذات طبيعة فلورية. وتعد هذه الطريقة فعالة وغير مدمرة بهدف تشكيل وكشف بصمات الأصابع الكامنة، ودائمًا ما يُقترح القيام بالاختبارات المعيارية واختبارات التحقق من موثوقية وصحة تركيب كاشف (IND) لتحسين كفاءة نتائج كشف بصمات الأصابع الكامنة على مجموعة واسعة من الأسطح ذات الأهمية الجنائية.

Keywords: Forensic Science, Latent Fingerprints, 1,2-indanedione, Amino Acids, Porous Surfaces.

الكلمات المفتاحية: علوم الأدلة الجنائية، بصمات الأصابع الكامنة، 1،2-إندانيديون، الأحماض الأمينية، الأسطح المسامية.

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CHAPTER 13

Recent developments in nanocatalyst-mediated ecofriendly synthesis of pyrimidine derivatives

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1. Introduction

Green chemistry employs a set of principles that minimizes or completely avoids the use of hazardous materials in the development, synthesis, and use of chemical products. This inspired researchers to hunt for effective strategies for removing homogeneous catalysts from the reaction medium and recycling them. Extensive research is being done on the use of magnetic nanoparticles (MNPs) as effective support for catalysts [1]. These nanoparticles typically consist of two parts: a chemical component and a magnetic component. Iron, nickel, and cobalt salts can be used as magnetic components. The bigger microbeads have a diameter between 0.5 and 500 μm, whereas nanoparticles typically have a diameter between 5 and 500 nm. Magnetic nanobeads, which have a diameter of 50–200 nm, are groupings of magnetic nanoparticles made up of numerous single magnetic nanoparticles [2].

The foundation for their subsequent magnetic construction into magnetic nanochains is magnetic nanoparticle clusters. Due to their appealing properties, magnetic nanoparticles have recently attracted a lot of attention. These nanomaterial-based catalysts have wide applications in biomedicine and tissue-specific targeting, magnetically tunable colloidal photonic crystals, microfluidics, magnetic resonance imaging, magnetic particle imaging, data storage, and environmental remediation, nanofluids, and optical filters,

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REVIEW ARTICLE

An Insight into Synthesis and Anticancer Potential of Thiazole and 4-thiazolidinone Containing Motifs

Devidas S. Bhagat[1,*], Pooja A. Chawla[2], Wasudeo B. Gurnule[3], Sampada K. Shejul[4] and Gurvinder S. Bumbrah[5]

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Devidas S. Bhagat

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Abstract: Over the years, the branch of oncology has reached a mature stage, and substantial development and advancement have been achieved in this dimension of medical science. The synthesis and isolation of numerous novel anticancer agents of natural and synthetic origins have been reported. Thiazole and 4-thiazolidinone containing heterocyclic compounds, having a broad spectrum of pharmaceutical activities, represent a significant class of medicinal chemistry. Thiazole and 4-thiazolidinone are five-membered unique heterocyclic motifs containing S and N atoms as an essential core scaffold and have commendable medicinal significance. Thiazoles and 4-thiazolidinones containing heterocyclic compounds are used as building blocks for the next generation of pharmaceuticals. Thiazole precursors have been frequently used due to their capabilities to bind to numerous cancer-specific protein targets. Suitably, thiazole motifs have a biological suit *via* inhibition of different signaling pathways involved in cancer causes. The scientific community has always tried to synthesize novel thiazole-based heterocycles by carrying out different replacements of functional groups or skeleton around thiazole moiety. Herein, we report the current trend of research and development in anticancer activities of thiazoles and 4-thiazolidinones containing scaffolds. In the current study, we have also highlighted some other significant biological properties of thiazole, novel protocols of synthesis for the synthesis of the new candidates, along with a significant broad spectrum of the anticancer activities of thiazole containing scaffolds. This study facilitates the development of novel thiazole and 4-thiazolidinone containing candidates with potent, efficient anticancer activity and less cytotoxic property.

Keywords: Heterocycle, thiazole, 4-thiazolidinone, synthesis, isolation, anti-cancer activity, oncology.

1. INTRODUCTION

Cancer disease exerts an enormous burden on the shoulder of the scientific community, pharmaceutical industries and governments throughout the world. It is caused due to the unrestrained, quick and pathological proliferation of abnormal growth of the cells, and it is one of the key issues of most difficult suffering in the Globe [1]. Daily hurdles of new drug discovery for the treatment of various types of cancer have demanded the development of new therapeutic agents and an efficient strategy for the replacement of old drugs with new ones [2]. In cancer therapy, the average time required for the development of a new drug molecule is around 13 years of research. In addition to this, few more years are also required for the design and production, evaluation of efficacy, toxicity, pharmacokinetic and pharmacodynamic profiles of the developed drug. Initially, this kind of study is mainly conducted on animal tissue, and if good results are produced, then it proceeds for human trial [3]. Four-decade before US National Cancer Institute firstly developed 60 human tumor cell lines for developed anticancer medicine by *in vitro* drug-discovery [4]. Cancer cure therapy includes radiation-therapy, chemotherapy, surgical intervention, targeted-therapy and other treatments [5].

A wide range of heterocyclic drugs showing anti-cancer activity is reported in the literature. Often the heteroatom that exists in the drug's moiety imparts a specific biological response. Amongst the heterocycle galaxy, the thiazole containing heterocycle has a broad spectrum of biological significance like antiviral, anti-inflammatory, antibacterial, and antifungal activities [6]. Annually, millions of individuals may die or suffer from cancer due to the lack of availability of an effective, inexpensive anti-cancer drug. Therefore, it becomes a global health issue, and there is no appropriate medicine for the treatment of this disease [7]. The globally estimated responsible death ratio due to cancer is 1:8 deaths. The people who face such kind of problems are also facing the economic crises related problem during its treatment [8]. In the arena of oncology, research scientist has a great challenge with social responsibility to discover novel and effective scaffolds with broad-spectrum anticancer properties [9]. Research in the discovery of anticancer drugs has great curiosity, and, therefore, the research community is actively

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An Insight into Ayurveda and Yogic Practices Sustain Physical and Mental Health in COVID-19 Pandemic

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Abstract: The worldwide public health disaster caused due to a viral outbreak of the coronavirus disease 2019 (COVID-19 or SARS-CoV-2) challenges the entire healthcare system. The COVID-19 is a highly pathogenic viral transmittable infection that causes the severe acute respiratory syndrome. It is a kind of pneumonia virus and the third type of coronavirus after severe acute respiratory syndrome (SARS) and the Middle East respiratory syndrome (MERS). In December 2019, the third coronavirus was discovered in patients with infectious respiratory disease in the capital city Wuhan, Hubei province, and initiate a global pandemic. It has a very high human-to-human transmission ability, which results in spread rapidly all over the world. Today's necessary to understand the physiopathology of COVID-19, which causes a global pandemic and infects more than 136 million people. The COVID-19 genome sequence is similar to the other two coronaviruses, with about 80% sequence identical with SARS-CoV and about 50 % with MERS-CoV. Remarkably, COVID-19 has a 90% similar whole-genome sequence with bat coronaviruses. The worldwide mortality rate of COVID-19 is 1 to 2%. Ayurvedic remedies; yogic practices like yogasanas, breathing pranayama, and meditation; other traditional Indian practices include decoction and drinking of herbal remedies. The Ayurveda, Yogic science, and other ancient practices boost the immune system, improve lung function, improve physiological strengths, normalize cognitive functions, and reduce the pandemic's community speeding. Ayurvedic remedies and yogic practices help to cope up with the COVID-19 pandemic. Yoga and ayurvedic were elements of daily routine practices of peoples in ancient times to keep themselves healthy.

Keywords: COVID-19; Ayurveda; Yogic practices; pandemic; health; ancient Indian practices.

1. Introduction

In December 2019, the global pandemic outbreak of SARS-CoV-2 in Wuhan, the capital city of Hubei province, spread dramatically into Wuhan city, with an ongoing risk of a global pandemic [1]. On 30th January 2020, the World Health Organization (WHO) declared