Impact of Plant Extracts in Neutralizing Threats from Bio-Organisms: Opening New Vistas in Bio Terror and Healthcare

Mr. Amul S Bahl

The author is an M.Tech from IIT-Delhi. As an electrical engineer he has developed energy-efficient technologies that use 40% less raw material.

Summary

Bio-organisms are a serious threat to mankind today. With the increasing resistance to antibiotics and few discoveries in new antibiotics, the healthcare risks of individuals and societies have increased manifold. Coupled to this, constant mutations in microbes need a different dimension to counter such bio-organisms. Alongside healthcare problems, deliberate use of bio-organisms as agents of terror is a threat that has no counter today. This paper presents 'Whiff Bio-Spray,' a breakthrough solution to neutralize these bio-organisms through the use of active plant extracts.

Introduction

A bio-organism, in Collins dictionary, is defined as "a dangerous fast-proliferating organism that could be used as the basis of a biological weapon"[1]. These bio-organisms can be in the form of bacteria, viruses, spores and other germs. These are also referred to as microbes and may cause serious health concerns. These bio-organisms/microbes are found in nature. But these bio-organisms can be made more lethal and harmful by increasing their ability to cause disease, spread, and/or to resist medical treatment on a large uncontrollable scale.[2]

Medical science has solutions to various diseases caused by these microbes. Antibiotics are one of the important treatment lines in modern medicine towards combating infections and providing a cure.[3] However, antibiotic resistance among microbes is a serious global concern.[4] There is also a simultaneous concern of microbe mutations which result in antibiotic resistance.[5] Antibiotic resistant bacteria resulted in at least 2 million infections and 23,000 deaths a year resulting in a 55-70 USD billion per year economic impact in the United States alone.[6] Under the recommendations of the US President's Council of Advisors on Science and Technology, President Barack Obama asked the National Security Council to prepare a draft for a comprehensive national action plan towards managing antibiotic resistance.[7] It is considered to be a challenging task to find new antibiotics due to the cost factor as well as the difficulty of finding new drugs by itself. It is suggested to have alternative solutions for the treatment and control of infections, like, non-antibiotic drugs, and non-bio-molecule

approaches.[8] Alternative therapies and herbal medicines are recommended as a credible solution.[9]

On the one hand, these bio-organisms can cause various diseases in a natural way but on the other hand, can be a cause of bioterrorism. The spectre of bio-terror may become larger than life due to subversive activities in backyard, rogue nations and disgruntled scientists in possession of these bio-organisms. Bioterrorism is a term referred to the intentional use of pathogenic strains of microbes to cause disease or death in living entities and/or to give harm to the environment.[10] There are always threats of bioterrorism, for example, the outbreak of pneumonic plague (well-known spread in biological warfare) in Surat and bubonic plague in Beed in 1994 put India's defence and intelligence units on alert.[11] Bioterrorism is a world-wide concern. In current times example, powdered anthrax spores were placed in letters mailed through the U.S. postal system in 2001 where 12 mail handlers got anthrax and five people died.[12] Since 2001, the United States Government has made significant efforts towards responding to acts of bio-terror. The 'National Strategy of Countering Biological Threats' by the United States shares to work nationally and internationally with possible partners for the health security of all people due to any kind of bio-threat. This strategy of countering biological threats includes all citizens, societies, communities and international partners to be aware and to have protection from bio-threats.[13] The bipartisan Blue-Ribbon Study Panel on Biodefence strongly indicates to have National Biodefence Strategy to protect the United States from bio-attacks. The Panel indicates that there is a need to assess how much has been done and what needs to be done more to protect The United States from bio-attack.[14] The US Senate passed the "Bioterrorism Act of 2002" to strengthen the area of biodefence.[15] It is many-a-times not known immediately whether the spread of bio-organisms is natural or accidental or deliberate. Therefore, bio-attack is a global threat rather than an isolated threat for a specific geographic area.

There are a number of agents which can be used for bioterrorism and are categorized into three categories (Figure 1); viz. Category A, B and C.[16] Figure 2 presents the risk attributes for these three categories of bioterrorism agents.

Figure 1: Categories of agents used in bioterrorism

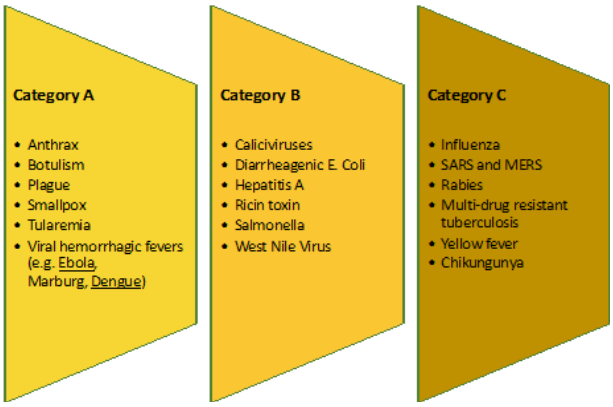
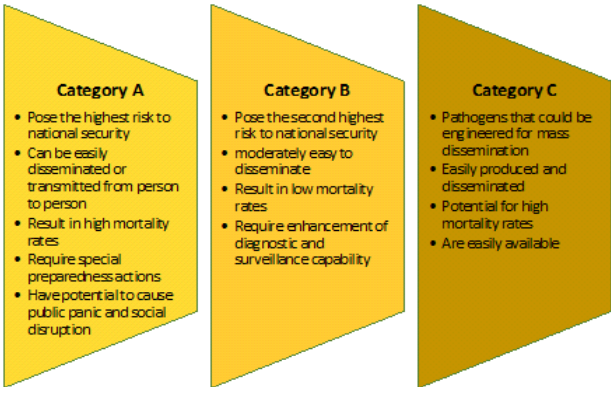


Figure 2: Understanding of risks with Category A, B and C bioterrorism causing agents



Thus, in sum, there are a number of risks (Figure 3) from bio-organisms causing the spread of diseases or the possibility of using them in bioterrorism. This is likely to result in a number of infections which become

difficult to cure due to bacteria or microbe's resistance to treatment (medicines) and adverse drug reactions. These are likely to lead toward treatment failures and economic losses.

Figure 3: Possible risks to living beings due to bio-organisms

These bio-organisms can spread via a number of mediums including air, water, in food or even from person to person.[17] There is a most likely disposition of these bio-organisms through the air either as an aerosolized or powered preparation.[18] The spread of bio-organisms needs protection of living entities across the globe like the spread of swine flu[19] took place beyond its place of origin. A high possibility of cocktail spread of bio-organisms especially in case of bioterrorism, it is difficult to ascertain a treatment of bio-attack because one may not identify a set of possible diseases due to a combination of unknown bio-organisms and their interactions. Such a scenario goes way beyond an epidemic like medical emergency and requires measures more urgent, emergent and drastic akin to disaster relief. In other words, multiple vectors need to be addressed concurrently.

Keeping in consideration the fatal effects of bio-organisms as a national as well as a global threat, the objective of this paper is to present a solution called Whiff bio-spray as a bio-defence in neutralizing the effects of bio-organisms for health care as well as to counter bioterrorism anywhere in the world.

Whiff Bio-Spray has been designed on the QLEN Model of disaster relief (developed by the author). The QLEN Model, when applied to Whiff Bio-Spray (Figure 5) is as follows:

Quick- mobile solutions hence quick response; also quick acting once sprayed

Localization- localize/confine infection to an area; avoid spread: Whiff bio-spray acts quickly to confine to a localized area thereby blunting the lethality of the spread of bio-organisms

Elimination- of bio-organisms

Neutralization- of the bio-organism/terror threat

This QLEN approach helps in achieving the key objectives as mentioned in a key US Government report- A National Blueprint for Biodefense: Leadership and Major Reform Needed to Optimize Efforts.[20] It helps towards the mission of the Federal Government during a biological incident which is to:

- save lives
- reduce human suffering
- protect property and the environment
- control the spread of disease
- support community efforts to overcome the physical, emotional, environmental, and economic impacts

A solution to bio-organisms: Whiff Bio-Spray

(a) Whiff bio-spray and it functioning

In Ayurveda literature, it is indicated that active phytochemical constituents of

individual plants can be used to form a polyherbal formulation for therapeutic effects.[21] Plant-extract oils have antibacterial and antifungal activities, and can also overcome problems of antibiotic resistance.[22]

Within the realm of Ayurvedic medicinal benefits, the author has developed a technological breakthrough (Figure 4) using plant-based extracts which is a simple, safe and effective herbal solution (referred as 'Whiff bio-spray' in this paper) to counter bio-organisms. It is a 100% natural spray of herbal extracts with no side effects and after-use did not leave any. In other words, there is no ecological fallout and get completely bio-assimilated without leaving behind any biological residue. The herbal contents of the bio-spray act as neutralizing agents which float in the air to neutralize bio-organisms in the air. The bio-spray was done with the help of micro-fog atomizer.[23] The micro-fog system enables the slow release of neutralizing agents in the bio-spray to float in the air to neutralize the air bio-organisms (Figure 5).

Figure 4: Whiff bio-spray features and benefits

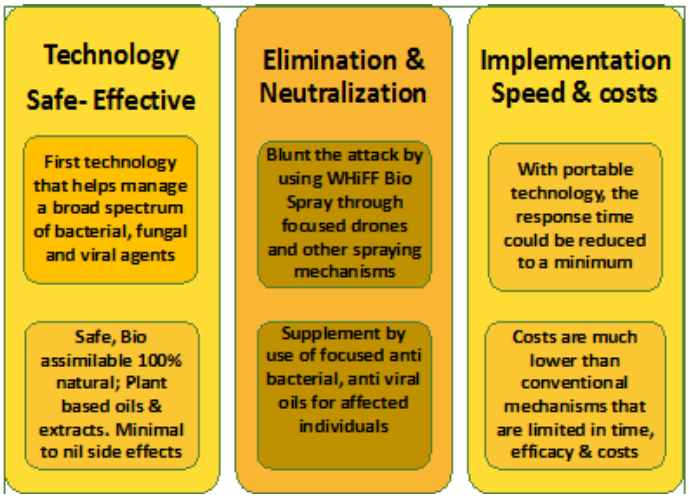
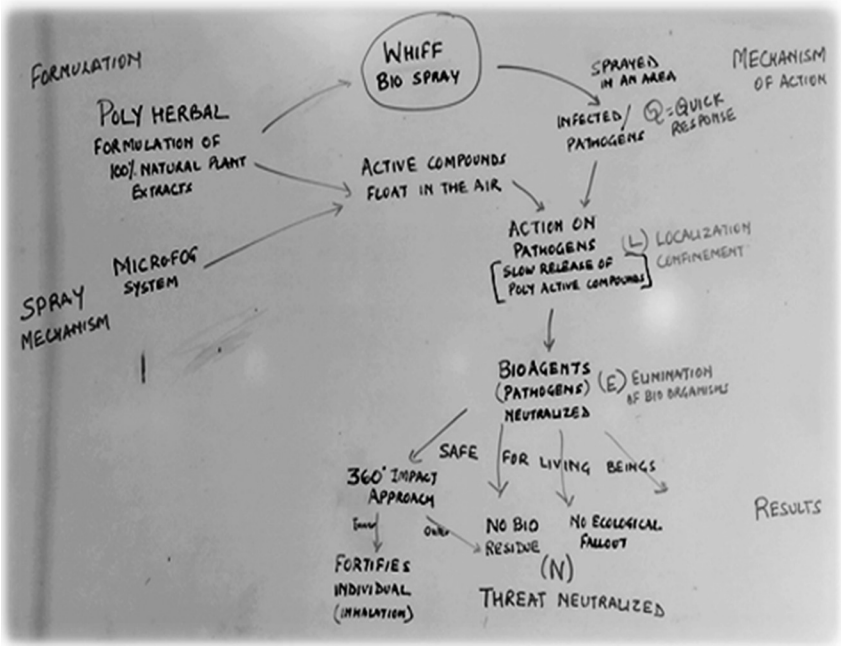


Figure 5: Functioning of Whiff bio-spray and QLEN Approach



Apart from the QLEN benefits, the Whiff bio-spray gives key strategic advantages through its deployment.

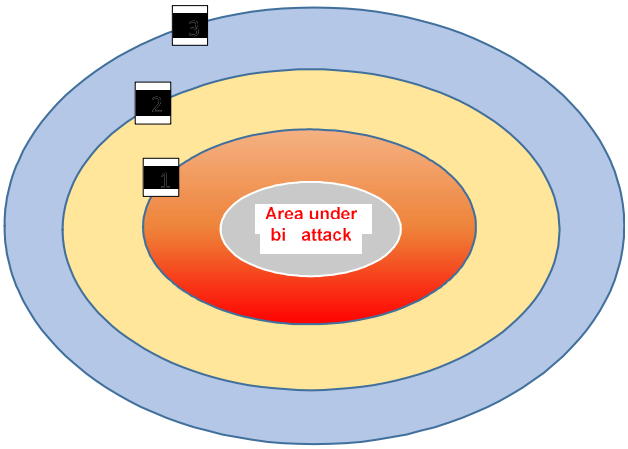
1. Quick acting and quick response: It acts in minutes to neutralize bio-organisms and thus can save precious human lives from being infected or death. It also arrests the spread of the bio-organisms at a fast pace.

2. Mobility: There is no requirement of huge capital expenditure or fixed equipment to spread Whiff bio-spray in the area under bio-attack. It can be deployed quickly and effectively at any place. In large open areas, low flying drones can be effectively used to spread Whiff bio-spray.

3. Comprehensive elimination of a broad spectrum of pathogenic payload: Whiff bio-spray is effective to eliminate a broad spectrum of pathogens and viruses and thus can effectively counter and neutralize a cocktail kind of bio-attack.

As a strategy to counter a bio-attack efficiently and effectively, Figure 6 illustrates a way of using Whiff bio-spray. Whiff bio-spray can be sprayed at three concentration levels (Figure 6) not only to counter bio-organisms effect in the affected area but also to manage the spread of bio-organisms in adjacent areas to neutralize the bio-terror threat and action. In other words, it will prevent the proliferation of bio-organisms from the area under bio-attack to surrounding areas. Further to use bio-spray at three concentration levels, there is a need to look at the wind direction and wind speed to let float bio-spray with air along bio-organisms.

Figure 6: Whiff Bio-Spray at three concentration levels of pathogenic bio-agents to counter and neutralize a bio-attack



Note: Concentration leaves of bio-agent where level 1, 2 and 3 means

Level 1 = Maximum concentration, Level 2 = Medium concentration, Level 3 = Low concentration

(b) Effectiveness of Whiff bio-spray

The bio-spray effectiveness was tested both in a laboratory environment and in a real-life situation. First, a test was conducted in a controlled laboratory set-up to study the impact of the bio-spray on drug resistant bio-organisms. This test was conducted at one of the laboratories certified by the National Accreditation Board of Testing and Calibration of Laboratories. The test on bio-organisms was done through the Four Plate test to map efficacy and anti-microbial action of the bio-spray on the air microbes. The bio-spray was further tested on total bacterial, yeast and mould count, E. Coli, Salmonella, Pseudomonas aeruginosa and Staphylococcus aureus. Viable bio-organisms were reported before bio-spray and 4 hours after bio-spray in 12x8 ft room. A notable reduction was measured in bio-organisms by 68-93% after bio-spray in the controlled laboratory room (Table 1). A higher concentrate Whiff bio-spray counters the pathogen count to completely eliminate them, as was seen in the pilot study conducted at AIIMS Delhi. The microbial count was also significantly countered by the Whiff bio-spray (Table 2).

Table 1: Bacteria Pathogen Plate test in laboratory (Report No. DTRLF-100118080)

Table 2: Microbial contamination test in the laboratory (Report No. DTRLF-100118076)

Microbial Test for	Result
Total bacterial count	Less than 10 cfu/ml
Total yeast and mould count	Less than 10 cfu/ml
E. Coli	Absent in 1 ml
Salmonella	Absent in 10 ml
Pseudomonas aeruginosa	Absent in 1ml
Staphylococcus aureus	Absent in 1ml

After the laboratory test, a bio-spray effectiveness pilot study was conducted in real-life set up in a controlled hospital environment in accordance to the protocol of the hospital at the Department of Microbiology of the All India Institute of Medical Sciences (AIIMS), Delhi. The results have shown a significant reduction in air-pathogens. This indicates that the bio-spray is effective to counter bio-agents/ bio-organisms in the air and in turn, will protect from the ill effects of it.

Discussion

Barton Gellman, an American journalist, has indicated that "in biological weapons, there is almost no prospect of detecting a pathogen until it has been used in an attack". Considering the same, Whiff bio-spray is an effective tool to counter a fatal attack due to unknown bio-organisms. Whiff bio-spray will be able to counter the air-borne spread of bio-organisms quickly irrespective of the geographical area, wherever required. It is efficient to protect the fatal effects of bio-attack on humans and animals by quick and comprehensive elimination and neutralization the bio-organisms. Thus, Whiff bio-spray is an effective decontamination measure. Decontamination means to remove or neutralize chemical and biological weapons (CBW) to limit their exposure to humans[24] and at present, there is no direct solution to neutralize and eliminate these bio-organisms (bio-weapons). Under biodefense against bio-attack, medical measures are suggested to protect people, viz. medicines and vaccinations; and other protective/preventive measures like non-exposure to air.[25] These measures work on the after-effects of bio-attack rather than on the exact payload of bio-attack (that is bio-organisms) where Whiff bio-spray is the effective bio-assimilable natural herbal solution.

Whiff bio-spray also helps reduce air pollutants; viz. PM2.5, PM10, formaldehyde (HCHO) and total volatile organic compound (TVOC)[26], and also improves air quality by reducing CO2 (Carbon-di-oxide) and reducing the impact of toxins in the air (Figure 7). This will result in curbing many respiratory diseases and in turn will lead to better health. A study identifies that in PM2.5 and PM10 samples of polluted air, the relative number of pathogenic bacteria was highest in the heavy and moderate polluted air.[27] Thus, it can be safely analysed that if a bio-attack happens in highly polluted air, even then Whiff bio-spray will be able to counter and neutralize bio-organisms as well as pollutant carriers. Further, a study indicates that plant-based essential oils are effective to deal with the problem of antibiotic resistance.[28] Again, Whiff bio-spray will be able to counter the antibiotic resistant bio-organisms. In reference to Figure 8, it will not be an exaggeration to indicate Whiff bio-spray as Vishwa Guru as an answer not only to counter pollution, counter negative effects of bio-organisms on health of living entities, counter antibiotic resistant microbes but also a solution for bioterrorism with no side-effects and resulting in organic elimination and neutralization of fatal organisms.

Figure 7: Role of Whiff bio-spray in improving air quality

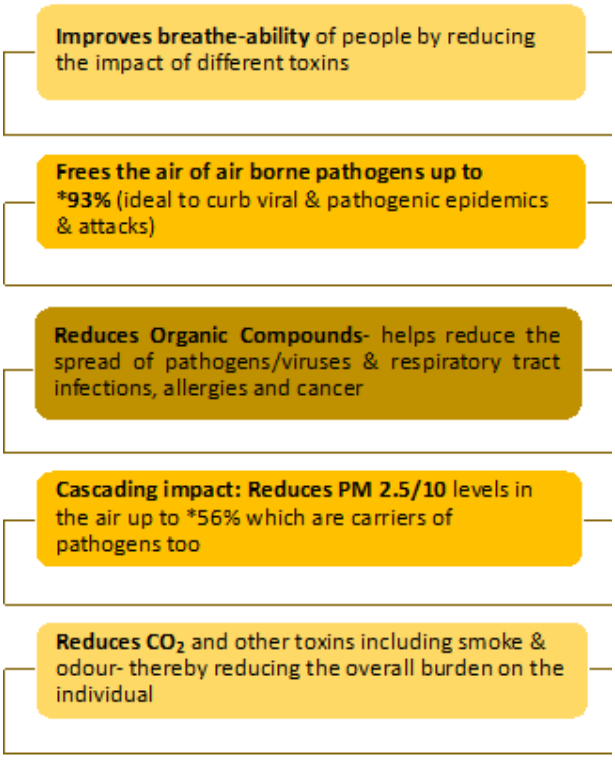
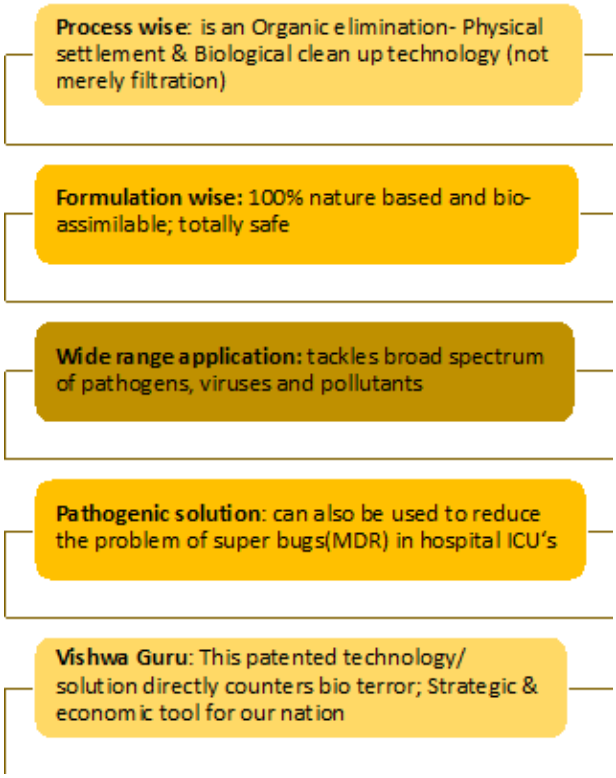


Figure 8: Whiff bio-spray in nutshell



Conclusion

Bio-organisms are a cause of fatal health conditions and global threat of bioterrorism. The countries across the globe are concerned and formulating measures to address the lethal effects of bio-organisms on mankind and all living beings in general. The present measures to protect health and environment are primarily addressing the after effects of bio-organisms rather than the cause (bio-organisms) itself. Whiff bio-spray is a primary measure to counter and neutralize pathogenic bio-agents directly by eliminating them from the area of attack whether towards naturally occurring diseases or towards accidental spread / deliberate bio-attack. Whiff bio-spray is 100% plant extract-based solution and bio-assimilable with no side-effects. Knowledge, access and usage of Whiff bio-spray can help individuals, communities and nations to fight bio-threats both safely and economically.

Endnotes:

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