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166

EDVO-Kit #

Detection of a Simulated Infectious Agent as a Biological Weapon

Storage:
Store entire experiment at room temperature.

Experiment Objective:

The objective of this experiment is to develop an understanding of how an infectious agent can be spread through a population.

EVT 010082AM

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Major Section Headings

Experiment Components

Storage:

Store the entire kit at room temperature.

None of the experiment components are derived from human sources.

This experiment is designed for 25 students.

Contents

A. Simulated Infectious Agent Powder
B. Control Powder
C. Glycerol Solution
Medium Gloves
Transfer pipets
Long wave UV "black light"

Requirements

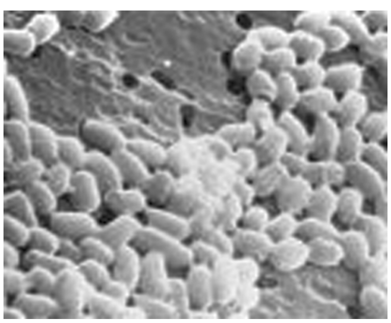
- Safety goggles
- Lab coats or protective clothing
- Optional - alternate size gloves
- AA batteries for UV light

BACKGROUND INFORMATION

Background Information

Since the events following September 11, 2001, we have become increasingly aware of threats and concerns that were rarely thought of previously. The potential spread of a biological weapon is something that our global community must contend with. Researchers look at many models to determine a community's readiness for attack. If a terrorist were to release 100 kilograms of aerosolized anthrax spores upwind of the U.S. Capital, it could kill between 130,000 and 3 million people. As another example, disseminating the pneumonic plague in Denver could create 3,700 or more cases, with an estimated 950 or more deaths within a week. If smallpox were released in Oklahoma City, it would take less than two months to kill approximately one million people worldwide. These are just a few frightening scenarios that could devastate our world and impact civilization.

The likelihood of such an event occurring remains arguable. The quantity of material required, the skill and technology involved to produce it, and the delivery methods are extremely difficult objectives to accomplish. A coordinated effort requires time, money, knowledge, and thorough testing. Using anthrax as an example, here are the steps involved:



Bacillus anthracis

- First, a terrorist group must get a virulent strain of *Bacillus anthracis* and then grow the organism in a lab, using specialized equipment to avoid self contamination.
- Next, the organism must be converted into spores and suspended in a solution that keeps it alive.
- Finally, the spore suspension must either be freeze-dried or kept in solution so it can be spread through a nozzle without clogging. The proper particle size required for infection must also be maintained which may require a special grinding step to make the spores airborne.

Developing an effective anthrax strain is challenging since the spores must be crafted to just the right size. If too small, a person will exhale the spores. If too large, the spores fall to the ground and die. People don't have to breathe in anthrax to become infected; they can also develop a skin form of the disease by touching the spores, though the skin form of the infection is far less lethal and easily detected and treated. Developing a smallpox agent is also difficult because the virus cannot be easily grown as a seed culture, and it is so deadly that lab workers trying to culture the virus could easily become infected and die.

Some of the equipment needed for bioweapons development, testing and manufacture includes large fermenters, centrifugal separators, cross-flow

BACKGROUND INFORMATION

Background Information, continued

filtration apparatus, freeze dryers, aerosol inhalation changers, and micro-encapsulation equipment. This equipment is very costly and expensive to maintain. Additionally, ecological conditions must be just right for an effective attack: too much or too little wind, too much sun or rain – each condition could damage an attack's effectiveness.

Anthrax, plague, and smallpox are among the most likely bioweapons that would be used in a large-scale attack. Few vaccines exist to defend against these diseases and diagnosis is often difficult and slow. The symptoms are similar to the flu or pneumonia. In order for treatment to be effective, it must be started early. Scientists are most concerned about smallpox and anthrax. Both can spread through the air in a powder and cause swift, deadly diseases. Smallpox could be especially lethal because it's easily spread from one person to another. One person infected with smallpox, for example, could pass along the disease to 20 or more individuals. Also worrisome are the bubonic plague, botulism, tularemia and Ebola.

Smallpox victim

Another concern is that terrorists could genetically engineer new strains of diseases that would be unaffected by current vaccines. Rapid detection of a disease outbreak remains a problem since many doctors have not been trained in how to recognize early symptoms of scourges like anthrax and smallpox. Early symptoms of anthrax can appear as a simple flu. The early signs of smallpox become more obvious about three days following exposure when lesions begin appearing. Some argue that emergency medical facilities are insufficient to handle a widespread attack.

How does an infectious microorganism spread throughout a population? Microbes can be transmitted by direct or indirect contact. Direct contact transmission occurs when there is actual physical contact between the host (the infected patient) and the susceptible person. A subdivision of direct contact is *vertical transmission*, the spread of disease from parent to offspring. Vertical transmission usually occurs when infectious microbes cross from a mother's bloodstream through the placenta to the fetus.

Indirect transmission often occurs by means of contaminated, inanimate objects such as bed sheets, clothing, towels, etc. Food handlers at restaurants can also transmit disease by contaminating food served to patrons. This means of spreading disease is the basis for strict regulation of eating establishments by local health departments. Indirect contact may also occur through the action of *vectors*, secondary organisms that do not themselves infect a host but transfer a disease-causing microorganism from one host to another. Vectors include mice, mosquitoes, ticks, and cockroaches. A well-known example of a vector-transmitted disease is malaria, which is propagated in tropical climates by mosquitoes.

BACKGROUND INFORMATION

Background Information, continued

Indirect contact can also occur through airborne infectious particles that travel from one person to another. A very familiar example of this is rhinovirus, or the common cold. Aerosol droplets from sneezes or coughs contain infectious virus particles that remain airborne or deposit themselves on surfaces. When susceptible persons inhale the droplets or touch contaminated surfaces and rubs their eyes or nose, they can become infected. This type of transmission underscores the importance of frequent hand washing during cold and flu season.

A strong defense against bio-terrorist attacks is critical to national and worldwide security. The public at all levels, starting with our youth, needs to develop an appreciation of how quickly a horizontal transmission of an infection occurs. Scientific research performed to detect, prevent, or combat a biological weapon could aid in other areas of research. Such benefits include better diagnostics for disease, improved vaccine production, and superior tools for dealing with natural-occurring diseases.

In this experiment, students will simulate the spread of an infectious agent by using a fluorescent powder to demonstrate how such a material can be transmitted through a population. Students will use "shaking hands" as the basis of the horizontal spread of an infection. A few of the students will start the infection using a fluorescent powder while others will use a non- fluorescent powder. The challenge will be to trace the infection to the primary source.

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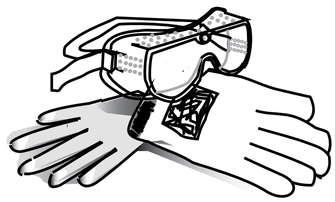
EXPERIMENTAL PROCEDURES



EXPERIMENT OBJECTIVE

The objective of this experiment is to develop an understanding of how an infectious agent can be spread through a population.

LABORATORY SAFETY

Gloves and safety goggles should be worn routinely as good laboratory practice.

Experimental Procedures

Assign a code number to each student.

1. Place a glove on the hand you don't use for writing.
2. Use a transfer pipet to apply a small amount of glycerol solution to the palm of your hand.Use care not to get the glycerol on your skin.
3. Sprinkle your powder sample on the sticky area of your gloved hand.
4. Use fingers of your gloved hand to spread the mixture on the same hand.You are now ready to perform the experiment.
5. Randomly select a student to be "contact 1"and shake hands. (At this point you will not be aware if he or she is a carrier of the infection).
6. Register the code of your contact 1 the chart on page 7.
7. Repeat for a second time steps 5 and 6 by randomly selecting a second student.
8. Repeat for a third time steps 5 and 6 by randomly selecting a third student.

EXPERIMENTAL PROCEDURES

Experimental Procedures, continued

9. Record your code and the three other contacts in Table A. You should record your code and the codes of the three simulated contacts you made. It is possible that one or more of the students or perhaps you yourself were the carrier of the infectious agents. Your Instructor knows the identity of the carrier(s)and it's up to you to determine who it is.

10. Use a long wave UV fluorescent black light to determine if you have contracted the "infectious agent".

    Note: Do not use a short wave UV light source (254-302 nm).

11. If your gloved hand fluoresces under the light,you or one of your contacts are a carrier of the disease.
    a) How many students have contracted the infectious agent?
    b) What percentage of the student groups does that cover?
    c) Who are the suspected carriers (they would be common among the groups whose hand fluoresced)?
    d) Can you determine the primary source(s)(the spreading point(s))of the infection?

Table A

	Transmission Codes		
Your Code	Contact 1	Contact 2	Contact 3

Study Questions

1. What are the most likely bioweapons that would be used in a large-scale terrorist attack?

2. Describe how a horizontal transmission of an infection occurs.

3. What are the differences between direct and indirect transmission?

4. What are some of the ways in which we can defend against a terrorist attack?

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INSTRUCTOR'S GUIDE

Pre-Lab Preparations

If you don't find answers to your questions in this section, call our

Technical Service Department

EDVO - TECH SERVICE
1-800-EDVOTEK
(1-800-338-6835)
edvotek@aol.com

Mon - Fri
9:00 am to
5:00 pm EST

24-hour FAX: (301) 340-0582
web: www.edvotek.com
email: edvotek@aol.com

Please have the following information:

- The kit number and title
- Kit lot number on box or tube
- The literature version number (in lower right corner)
- Approximate purchase date

1. Assemble the following materials for 25 students (one each per student):

    - 1 glove
    - 1 tube of control powder or simulated infectious agent powder
    - 1 transfer pipet

2. Have the students acquire some of the glycerol solution to use as a sticking agent for the powder.

3. Students will need to record the contacts they make in the chart found on page 7.

4. Make sure that you know the identity of the infectious agent carrier. Do not inform the students of their sample type.

5. Have a station set up in a dark area of the lab for UV visualization with the longwave black light(s).

Please refer to the kit insert for the Answers to Study Questions

Material Safety Data Sheet

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May be used to comply with OSHA's Hazard Communication Standard. 29 CFR 1910.1200 Standard must be consulted for specific requirements.

IDENTITY (As Used on Label and List): Fluorescent Dye	Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name: **EDVOTEK, Inc.**	Emergency Telephone Number: **(301) 251-5990**
Address (Number, Street, City, State, Zip Code): **14676 Rothgeb Drive, Rockville, MD 20850**	Telephone Number for information: **(301) 251-5990**
	Date Prepared: 6/24/02
	Signature of Preparer (optional)

Section II - Hazardous Ingredients/Identify Information

Hazardous Components [Specific Chemical Identity; Common Name(s)]	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (Optional)
Dyed Resin				
No Hazardous component				
Treat as nuisance dust				

Section III - Physical/Chemical Characteristics

Boiling Point For 1% solution	N/A	Specific Gravity (H_2O = 1)	~1.4
Vapor Pressure (mm Hg.)	N/A	Melting Point	No data
Vapor Density (AIR = 1)	N/A	Evaporation Rate (Butyl Acetate = 1)	N/A

Solubility in Water: None

Appearance and Odor: Fine powder (various colors), slight aldehyde odor

Section IV - Physical/Chemical Characteristics

N.D. = No data

Flash Point (Method Used)	Flammable Limits	LEL	UEL
Not combustible		N.D.	N.D.

Extinguishing Media: Not combustible

Special Fire Fighting Procedures: Wear self-contained breathing apparatus and protective clothing

Unusual Fire and Explosion Hazards: May emit toxic vapors under fire conditions

Section V - Reactivity Data

Stability			Conditions to Avoid
	Unstable		
	Stable	X	

Incompatibility: Strong oxidizing agents

Hazardous Decomposition or Byproducts: May produce toxic fumes of Carbon Monoxide, Carbon Dioxide, Nitrogen Oxides under fire conditions

Hazardous Polymerization			Conditions to Avoid
	May Occur		Excessive dust in the vicinity of electrical or spark generating equipment
	Will Not Occur	X	

Section VI - Health Hazard Data

Route(s) of Entry:	Inhalation? Yes	Skin? Np	Ingestion? Yes

Health Hazards (Acute and Chronic): Not condisered to be hazardous, but treat as a nuisance dust

Carcinogenicity:	NTP?	IARC Monographs?	OSHA Regulation?

Signs and Symptoms of Exposure: May cause eye, skin or respiratory irritation

Medical Conditions Generally Aggravated by Exposure: May cause eye, skin or respiratory irritation

Emergency First Aid Procedures: Eyes: Flush with cool tap water for at least 15 min. Skin: Wash thoroughly with warm water. Respiratory: Remove to fresh air, if distress continues administer oxygen and call doctor. Ingestion: Drink large amount of water.

Section VII - Precautions for Safe Handling and Use

Steps to be Taken in case Material is Released for Spilled: Eliminate all sources of ignition. Wear protective equipment. for small spills of aqueous suspension, absorb on paper towels, evaporate in fume hood. Burn absorbed material in an incinerator. If dry, minimize dust.

Waste Disposal Method: Dispose of waste in accordance with current Federal, State and Local codes and guidelines.

Precautions to be Taken in Handling and Storing: Store according to package and MSDS instructions. Store in a cool, well ventilated area. Keep away from reactive materials and away from fire hazard or source of ignition.

Other Precautions

Section VIII - Control Measures

Respiratory Protection (Specify Type): NIOSH/MSNA approved Nuisance Dust Respirator

Ventilation		
	Local Exhaust	Special
	Mechanical (General)	Other

Protective Gloves	Chemical Resistant	Eye Protection	Splash proof goggles

Other Protective Clothing or Equipment: Eye wash fountain and safety shower should be readily available where the potenial for eye contact with the reajent exists.

Work/Hygienic Practices: Wash thoroughly after handling.