

334
EDVO-Kit #

**PCR-based VNTR
Human DNA Typing**

Storage:
See page 2 for specific instructions.

Experiment Objective:

The objective of this experiment is for students to isolate human DNA and compare DNA polymorphisms between individuals

All components are intended for educational research only. They are not to be used for diagnostic or drug purposes, nor administered to or consumed by humans or animals.

Major Section Headings

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Experiment Components

This experiment contains material for 25 human DNA typing reactions.

Contents	Storage
A D1S80 primer mix	-20°C Freezer
B Tris Buffer	-20°C Freezer
C 200 base pair ladder	-20°C Freezer
D Chelating Agent	Room Temperature
E 10x PBS	Room Temperature
F PCR Tubes with Beads which contain:	Room Temperature
a. dNTP Mixture	
b. Taq DNA Polymerase Buffer	
c. Taq DNA Polymerase	
d. MgCl ₂	
<ul style="list-style-type: none"> • UltraSpec-Agarose™ • Electrophoresis Buffer (50x) • 10x Gel Loading Solution • DNA InstaStain/EtBr™ sheets • Microcentrifuge Tubes (2 ml) • Microcentrifuge Tubes (1.5 ml) • Screw cap conical tubes (15 ml) • Cotton Swabs • Calibrated transfer pipets 	

* The PCR process and Taq DNA polymerase are covered by patents owned by Hoffman-LaRoche, Inc.

** Taq DNA polymerase is purchased from a licensed distributor.

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Requirements

- Thermal Cycler (EDVOTEK Cat. #532 is highly recommended)
- Horizontal Gel Electrophoresis Apparatus
- D.C. Power Supply
- Microcentrifuge
- UV Transilluminator
- UV Photodocumentation System (optional)
- Automatic Micropipets (5-50 μ l) and Tips
- Hot plate
- Hot Gloves
- Distilled or Deionized Water
- Pipet Pump
- 250 ml Flasks or beakers
- Ice buckets and ice
- UV Safety Goggles
- Disposable laboratory gloves

Background Information

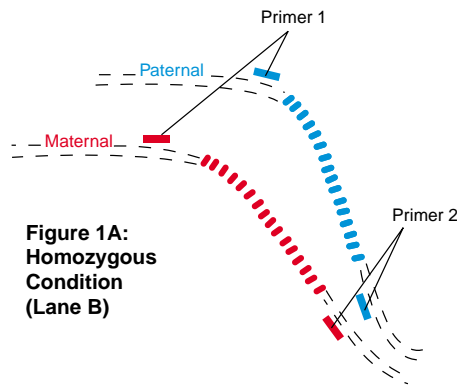


Figure 1A:
Homozygous
Condition
(Lane B)

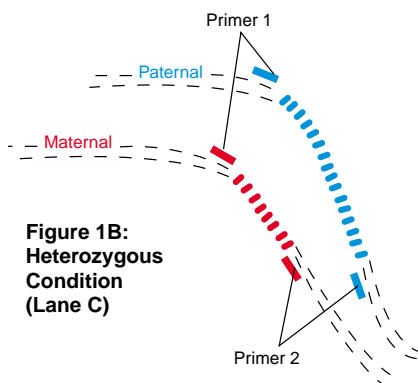


Figure 1B:
Heterozygous
Condition
(Lane C)

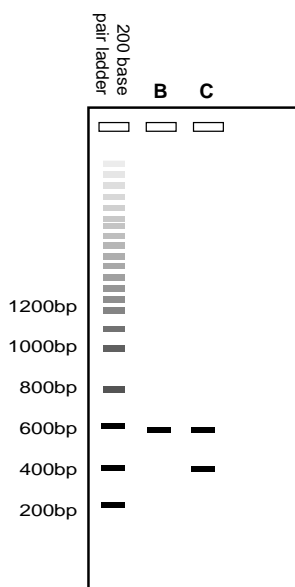


Figure 1:
PCR Amplification
Products of D1S80 Locus

Polymorphic DNA refers to chromosomal regions that vary widely from individual to individual. By examining several of these regions within the genomic DNA obtained from an individual, one may obtain a "DNA Fingerprint" for that individual. Such DNA fingerprints are now used routinely to identify or exonerate criminal suspects, identify human remains, and determine paternity or kinship. DNA polymorphisms are also used as markers for certain diseases that have a genetic basis.

The most commonly used polymorphisms are those which vary in length; these are known as fragment length polymorphisms (FLPs). Restriction fragment length polymorphisms (RFLPs) result when genomic DNA is digested with a specific restriction enzyme and a labeled probe is allowed to hybridize to a specific region of DNA. This allows the investigator to examine variations in the enzyme's restriction sites within that particular region. The RFLP technique requires relatively large (microgram) amounts of DNA and also requires Southern blotting and hybridization, making it quite a laborious and time-consuming procedure. It does, however, make identification of individuals statistically quite conclusive. RFLP analysis remains in widespread use in medicine in the identification of genetic disease markers.

An alternative to RFLP examination is one in which the polymerase chain reaction (PCR) is used to amplify FLPs. These amplified sequences are thus referred to as AMPFLPs. FLPs known as Variable Number of Tandem Repeats (VNTRs) are DNA regions that contain specific sequences duplicated a variable number of times. This duplication number varies widely between individuals. One VNTR known as D1S80, is present on chromosome 1 and contains a 16 nucleotide sequence which is variably repeated between 16 and 40 times. An individual who is homozygous for the D1S80 genotype will have equal repeat numbers on both homologues of chromosome 1, displaying a single PCR product following AMPFLP analysis (Fig. 1A). More commonly, a person will be heterozygous, with differing D1S80 repeat numbers. Amplification of DNA from heterozygous individuals will result in two distinct PCR products (Fig. 1B). The D1S80 locus is one VNTR used by the FBI and other investigative agencies. For many applications, the use of AMPFLPs is now replacing RFLP technology, as it is less time-consuming and requires less sample DNA (an important consideration in forensics).

To perform DNA typing, almost any tissue or body fluid (except urine) may be used. The most common sources are blood, hair, and saliva. The cells collected must be treated to release their DNA into solution.

BACKGROUND INFORMATION

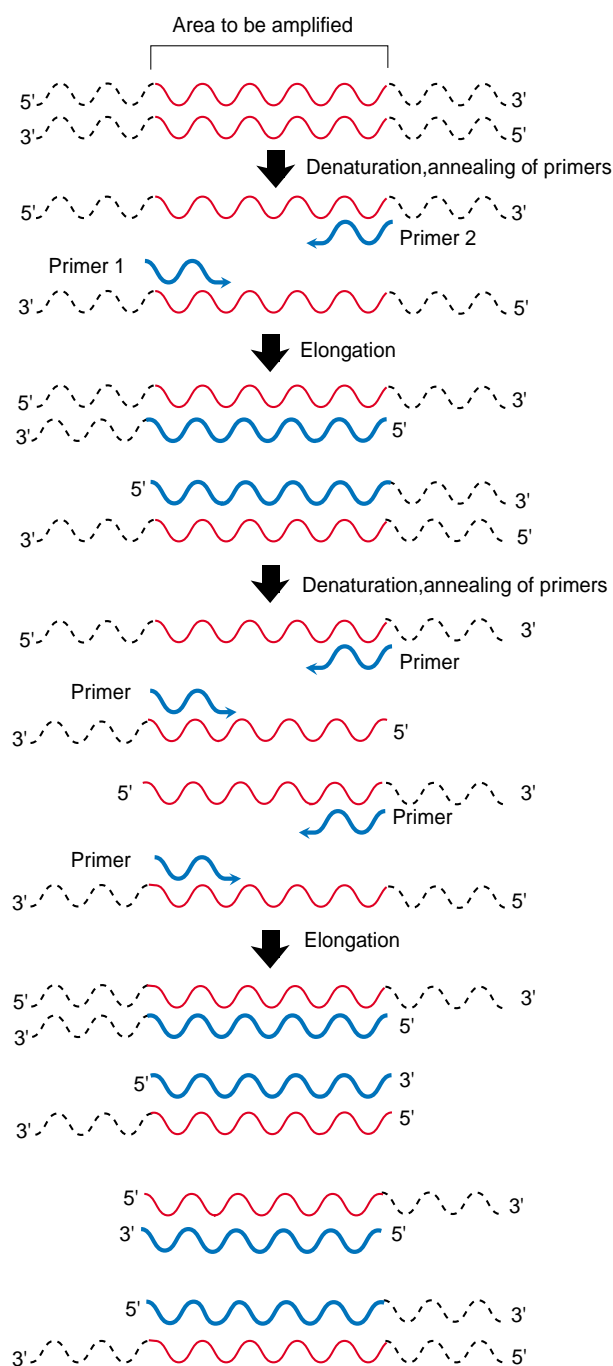
Background Information,
continued


Figure 2 - The Polymerase Chain Reaction (PCR)

In forensic laboratories, specimens collected from crime scenes are treated by various methods to lyse the cell membranes and release the DNA. Following lysis, the cells are often resuspended in a chelating agent, which removes cellular cations that inhibit PCR. The DNA is then subjected to RFLP or AMPFLP analysis. The profile obtained is then compared with analysis of DNA from the victim or suspect. A DNA match between the crime scene sample and a suspect indicates that the suspect was present at the scene.


As mentioned above, AMPFLP analysis uses the polymerase chain reaction (PCR). PCR, was invented in 1984 by Kary Mullis who was awarded a Nobel Prize for his work in 1994. The enormous utility of PCR is based on its ease of use and its ability to amplify DNA. The PCR amplification (Figure 2) uses an enzyme known as *Taq* polymerase. This enzyme is purified from a bacterium originally isolated from hot springs and is stable at very high temperatures. Also included in the PCR reaction mixture are two (15-30 nucleotide) synthetic oligonucleotides, known as "primers" and the extracted DNA template also known as the target DNA.

In the first step of the PCR reaction, the target complementary DNA strands are melted / separated from each other at 94°C, while the *Taq* polymerase remains stable. In the second step, known as annealing, the sample is cooled to 65°C to allow hybridization of the two primers to the two strands of the target DNA. In this experiment, the target is the D1S80 locus in the extracted DNA. In the third step, the temperature is raised to 72°C and the *Taq* polymerase adds nucleotides to the primers to complete the synthesis of the new complementary strands. These three steps - denaturation, annealing, and DNA synthesis - constitute "one PCR cycle". This process is typically repeated for 20-30 cycles, amplifying the target sequence exponentially (Figure 2). PCR is performed in a thermal cycler, which is programmed to rapidly heat, cool and maintain samples at designated temperatures for varying amounts of time.


In this experiment, each student will extract his/her DNA from cheek cells, amplify DNA at the D1S80 locus by PCR, and examine the PCR products on agarose gels. Objectives of this experiment are the isolation of human DNA and the comparison of DNA polymorphisms between individuals by PCR amplification and gel electrophoresis.

 Material Safety Data Sheet 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) Agarose		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		Emergency Telephone Number (301) 251-5990	
Manufacturer's Name EDVOTEK, Inc.		Telephone Number for information (301) 251-5990	
Address (Number, Street, City, State, Zip Code) 14676 Rothgeb Drive Rockville, MD 20850		Date Prepared 09-15-2002	
		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)			
This product contains no hazardous materials as defined by the OSHA Hazard Communication Standard.			
CAS #9012-36-6			
Section III - Physical/Chemical Characteristics			
Boiling Point For 1% solution	194° F	Specific Gravity (H ₂ O = 1)	No data
Vapor Pressure (mm Hg.)	No data	Melting Point	No data
Vapor Density (AIR = 1)	No data	Evaporation Rate (Butyl Acetate = 1)	No data
Solubility in Water Insoluble - cold			
Appearance and Odor White powder, no odor			
Section IV - Physical/Chemical Characteristics N.D. = No data			
Flash Point (Method Used)	No data	Flammable Limits	LEL N.D. UEL N.D.
Extinguishing Media Water spray, dry chemical, carbon dioxide, halon or standard foam			
Special Fire Fighting Procedures Possible fire hazard when exposed to heat or flame			
Unusual Fire and Explosion Hazards None			


Section V - Reactivity Data			
Stability	Unstable		Conditions to Avoid
	Stable	X	None
Incompatibility No data available			
Hazardous Decomposition or Byproducts			
Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	X	None
Section VI - Health Hazard Data			
Route(s) of Entry: Inhalation? Yes Skin? Yes Ingestion? Yes			
Health Hazards (Acute and Chronic) Inhalation: No data available Ingestion: Large amounts may cause diarrhea			
Carcinogenicity: NTP? IARC Monographs? OSHA Regulation?			
Signs and Symptoms of Exposure No data available			
Medical Conditions Generally Aggravated by Exposure No data available			
Emergency First Aid Procedures Treat symptomatically and supportively			
Section VII - Precautions for Safe Handling and Use			
Steps to be Taken in case Material is Released for Spilled Sweep up and place in suitable container for disposal			
Waste Disposal Method Normal solid waste disposal			
Precautions to be Taken in Handling and Storing None			
Other Precautions None			
Section VIII - Control Measures			
Respiratory Protection (Specify Type) Chemical cartridge respirator with full facepiece.			
Ventilation	Local Exhaust		Special
	Mechanical (General)	Gen. dilution ventilation	Other
Protective Gloves	Yes		Eye Protection Splash proof goggles
Other Protective Clothing or Equipment Impervious clothing to prevent skin contact			
Work/Hygienic Practices None			

 Material Safety Data Sheet 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) InstaStain™ Ethidium Bromide		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		Emergency Telephone Number (301) 251-5990	
Manufacturer's Name EDVOTEK, INC P.O. Box 1232 West Bethesda, MD 20827		Telephone Number for information (301) 251-5990	
		Date Prepared 09-17-2002	
		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)			
Ethidium Bromide Data not available			
(2,7-Diamino-10-Ethyl-9-Phenylphenanthridinium Bromide)			
CAS# 139-33-3			
Section III - Physical/Chemical Characteristics			
Boiling Point	No data	Specific Gravity (H ₂ O = 1)	No data
Vapor Pressure (mm Hg.)	No data	Melting Point	No data
Vapor Density (AIR = 1)	No data	Evaporation Rate (Butyl Acetate = 1)	No data
Solubility in Water Soluble			
Appearance and Odor Chemical bound to paper, no odor			
Section IV - Physical/Chemical Characteristics N.D. = No data			
Flash Point (Method Used)	No data	Flammable Limits	LEL N.D. UEL N.D.
Extinguishing Media Water spray, carbon dioxide, dry chemical powder, alcohol or polymer foam			
Special Fire Fighting Procedures Wear protective clothing and SCBA to prevent contact with skin & eyes			
Unusual Fire and Explosion Hazards Emits toxic fumes			


Section V - Reactivity Data			
Stability	Unstable		Conditions to Avoid
	Stable	X	None
Incompatibility Strong oxidizing agents			
Hazardous Decomposition or Byproducts Carbon monoxide, Carbon dioxide, nitrogen oxides, hydrogen bromide gas			
Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	X	None
Section VI - Health Hazard Data			
Route(s) of Entry: Inhalation? Yes Skin? Yes Ingestion? Yes			
Health Hazards (Acute and Chronic) Chronic: May alter genetic material Acute: Material irritating to mucous membranes, upper respiratory tract, eyes, skin			
Carcinogenicity: No data available NTP? IARC Monographs? OSHA Regulation?			
Signs and Symptoms of Exposure Irritation to mucous membranes and upper respiratory tract			
Medical Conditions Generally Aggravated by Exposure No data			
Emergency First Aid Procedures Treat symptomatically and supportively			
Section VII - Precautions for Safe Handling and Use			
Steps to be Taken in case Material is Released for Spilled Wear SCBA, rubber boots, rubber gloves			
Waste Disposal Method Mix material with combustible solvent and burn in a chemical incinerator equipped afterburner and scrubber			
Precautions to be Taken in Handling and Storing Use in chemical fume hood with proper protective lab gear.			
Other Precautions Mutagen			
Section VIII - Control Measures			
Respiratory Protection (Specify Type) SCBA			
Ventilation	Local Exhaust	Yes	Special Chem. fume hood
	Mechanical (General)	No	Other None
Protective Gloves	Rubber		Eye Protection Chem. safety goggles
Other Protective Clothing or Equipment Rubber boots			
Work/Hygienic Practices Use in chemical fume hood with proper protective lab gear.			

 <p align="center">Material Safety Data Sheet May be used to comply with OSHA's Hazard Communication Standard. 29 CFR 1910.1200 Standard must be consulted for specific requirements.</p>			
IDENTITY (As Used on Label and List) 50x Electrophoresis Buffer		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		Emergency Telephone Number (301) 251-5990	
Manufacturer's Name EDVOTEK, Inc.		Telephone Number for information (301) 251-5990	
Address (Number, Street, City, State, Zip Code) 14676 Rothgeb Drive Rockville, MD 20850		Date Prepared 09-17-2002	
		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)			
This product contains no hazardous materials as defined by the OSHA Hazard Communication Standard.			
Section III - Physical/Chemical Characteristics			
Boiling Point	No data	Specific Gravity (H ₂ O = 1)	No data
Vapor Pressure (mm Hg.)	No data	Melting Point	No data
Vapor Density (AIR = 1)	No data	Evaporation Rate (Butyl Acetate = 1)	No data
Solubility in Water Appreciable, (greater than 10%)			
Appearance and Odor Clear, liquid, slight vinegar odor			
Section IV - Physical/Chemical Characteristics N.D. = No data			
Flash Point (Method Used)	No data	Flammable Limits	LEL N.D. UEL N.D.
Extinguishing Media Use extinguishing media appropriate for surrounding fire.			
Special Fire Fighting Procedures Wear protective equipment and SCBA with full facepiece operated in positive pressure mode.			
Unusual Fire and Explosion Hazards None identified			


Section V - Reactivity Data			
Stability	Unstable		Conditions to Avoid
	Stable	X	None
Incompatibility Strong oxidizing agents			
Hazardous Decomposition or Byproducts Carbon monoxide, Carbon dioxide			
Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	X	None
Section VI - Health Hazard Data			
Route(s) of Entry: Inhalation? Yes Skin? Yes Ingestion?			
Health Hazards (Acute and Chronic) None			
Carcinogenicity: None identified NTP? IARC Monographs? OSHA Regulation?			
Signs and Symptoms of Exposure Irritation to upper respiratory tract, skin, eyes			
Medical Conditions Generally Aggravated by Exposure None			
Emergency First Aid Procedures Ingestion: If conscious, give large amounts of water Eyes: Flush with water Inhalation: Move to fresh air Skin: Wash with soap and water			
Section VII - Precautions for Safe Handling and Use			
Steps to be Taken in case Material is Released for Spilled Wear suitable protective clothing. Mop up spill and rinse with water, or collect in absorbent material and dispose of the absorbent material.			
Waste Disposal Method Dispose in accordance with all applicable federal, state, and local environmental regulations.			
Precautions to be Taken in Handling and Storing Avoid eye and skin contact.			
Other Precautions None			
Section VIII - Control Measures			
Respiratory Protection (Specify Type)			
Ventilation	Local Exhaust	Yes	Special None
	Mechanical (General)	Yes	Other None
Protective Gloves	Yes		Eye Protection Goggles
Other Protective Clothing or Equipment None			
Work/Hygienic Practices None			

 <p align="center">Material Safety Data Sheet May be used to comply with OSHA's Hazard Communication Standard. 29 CFR 1910.1200 Standard must be consulted for specific requirements.</p>			
IDENTITY (As Used on Label and List) Gel loading solution concentrate, 10x		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		Emergency Telephone Number (301) 251-5990	
Manufacturer's Name EDVOTEK, Inc.		Telephone Number for information (301) 251-5990	
Address (Number, Street, City, State, Zip Code) 14676 Rothgeb Drive Rockville, MD 20850		Date Prepared 09-17-2002	
		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)			
This product contains no hazardous materials as defined by the OSHA Hazard Communication Standard.			
Section III - Physical/Chemical Characteristics			
Boiling Point	No data	Specific Gravity (H ₂ O = 1)	No data
Vapor Pressure (mm Hg.)	No data	Melting Point	N/A
Vapor Density (AIR = 1)	No data	Evaporation Rate (Butyl Acetate = 1)	No data
Solubility in Water soluble			
Appearance and Odor Blue liquid, no odor			
Section IV - Physical/Chemical Characteristics			
Flash Point (Method Used)	No data	Flammable Limits	LEL No data UEL No data
Extinguishing Media Dry chemical, carbon dioxide, water spray or foam			
Special Fire Fighting Procedures Use agents suitable for type of surrounding fire. Keep upwind, avoid breathing hazardous sulfur oxides and bromides. Wear SCBA.			
Unusual Fire and Explosion Hazards Unknown			

Section V - Reactivity Data			
Stability	Unstable		Conditions to Avoid
	Stable	X	None
Incompatibility None known			
Hazardous Decomposition or Byproducts Sulfur oxides and bromides			
Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	X	None
Section VI - Health Hazard Data			
Route(s) of Entry: Inhalation? Yes Skin? Yes Ingestion? Yes			
Health Hazards (Acute and Chronic) Acute eye contact: May cause irritation No data available for other routes			
Carcinogenicity: None NTP? No data IARC Monographs? No data OSHA Regulation? No data			
Signs and Symptoms of Exposure May cause skin or eye irritation			
Medical Conditions Generally Aggravated by Exposure None reported			
Emergency First Aid Procedures Treat symptomatically and supportively Rinse contacted area with copious amounts of water.			
Section VII - Precautions for Safe Handling and Use			
Steps to be Taken in case Material is Released for Spilled Rinse contacted area with copious amounts of water.			
Waste Disposal Method Observe all federal, state, and local regulations.			
Precautions to be Taken in Handling and Storing Avoid eye and skin contact.			
Other Precautions None			
Section VIII - Control Measures			
Respiratory Protection (Specify Type) Chemical cartridge respirator with organic vapor cartridge.			
Ventilation	Local Exhaust	Yes	Special Yes
	Mechanical (General)	Yes	Other None
Protective Gloves	yes		Eye Protection splash proof goggles
Other Protective Clothing or Equipment None required			
Work/Hygienic Practices Do not ingest. Avoid contact with skin, eyes and clothing. Wash thoroughly after handling.			

 Material Safety Data Sheet 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) Chelating Agent	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 09-16-2002		
	Signature of Preparer (optional)		
Section II - Hazardous Ingredients/Identify Information			
Hazardous Components [Specific Chemical Identity; Common Name(s)] Iminodiacetic Acid CAS #142-73-4	OSHA PEL ACGIH TLV Other Limits Recommended % (Optional)		
Section III - Physical/Chemical Characteristics			
Boiling Point	No data	Specific Gravity (H ₂ O = 1)	No data
Vapor Pressure (mm Hg.)	No data	Melting Point	No data
Vapor Density (AIR = 1)	No data	Evaporation Rate (Butyl Acetate = 1)	No data
Solubility in Water	Soluble		
Appearance and Odor	White fluffy granules (hygroscopic), odorless		
Section IV - Physical/Chemical Characteristics N.D. = No data			
Flash Point (Method Used)	No data	Flammable Limits	LEL N.D. UEL N.D.
Extinguishing Media	Dry chemical, carbon dioxide, water spray or regular foam		
Special Fire Fighting Procedures	Wear NIOSH/MSHA approved SCBA and full protective equipment.		
Unusual Fire and Explosion Hazards	None specified		

Section V - Reactivity Data			
Stability	Unstable		Conditions to Avoid
	Stable	X	None specified
Incompatibility	Strong oxidizing agents		
Hazardous Decomposition or Byproducts	Toxic fumes of carbon monoxide, carbon dioxide, nitrogen oxides		
Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	X	Incompatibles
Section VI - Health Hazard Data			
Route(s) of Entry:	Inhalation? Yes	Skin? Yes	Ingestion? Yes
Health Hazards (Acute and Chronic)	Irritating to mucous membranes		
Carcinogenicity:	No data	NTP?	IARC Monographs? OSHA Regulation?
Signs and Symptoms of Exposure	None specified		
Medical Conditions Generally Aggravated by Exposure	No data		
Emergency First Aid Procedures	Skin/Eyes: Immediately flush with copious amounts of water for 15 min. Inhalation: Remove to fresh air, if not breathing give artificial respiration, if difficulty breathing give oxygen Ingestion: Wash out mouth with water. Call physician.		
Section VII - Precautions for Safe Handling and Use			
Steps to be Taken in case Material is Released for Spilled	Wear suitable protective clothing. Sweep up and place in suitable container for later disposal.		
Waste Disposal Method	Observe all federal, state, and local regulations		
Precautions to be Taken in Handling and Storing	Keep tightly closed in a cool, dry place		
Other Precautions	Avoid contact		
Section VIII - Control Measures			
Respiratory Protection (Specify Type)			
Ventilation	Local Exhaust	Yes	Special None
	Mechanical (General)	No	Other None
Protective Gloves	Yes	Eye Protection	Chem proof goggles
Other Protective Clothing or Equipment	Eye wash		
Work/Hygienic Practices	Wear protective clothing and equipment to prevent contact.		

 Material Safety Data Sheet 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) 10x PBS	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 09-19-2002		
	Signature of Preparer (optional)		
Section II - Hazardous Ingredients/Identify Information			
Hazardous Components [Specific Chemical Identity; Common Name(s)] N/A Blend	OSHA PEL ACGIH TLV Other Limits Recommended % (Optional)		
Section III - Physical/Chemical Characteristics			
Boiling Point	100°C	Specific Gravity (H ₂ O = 1)	1.017
Vapor Pressure (mm Hg.)	No data	Melting Point	No data
Vapor Density (AIR = 1)	No data	Evaporation Rate (Butyl Acetate = 1)	No data
Solubility in Water	soluble		
Appearance and Odor	colorless liquid		
Section IV - Physical/Chemical Characteristics			
Flash Point (Method Used)	Noncombustible	Flammable Limits	LEL UEL
Extinguishing Media	Use extinguishing media appropriate to surrounding fire		
Special Fire Fighting Procedures	Wear SCBA and protective clothing to prevent contact with skin and eyes		
Unusual Fire and Explosion Hazards	Emits toxic fumes under fire conditions		

Section V - Reactivity Data			
Stability	Unstable		Conditions to Avoid
	Stable		
Incompatibility	Strong acids		
Hazardous Decomposition or Byproducts	Nature of decomposition products not known		
Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur		
Section VI - Health Hazard Data			
Route(s) of Entry:	Inhalation? Yes	Skin? Yes	Ingestion? Yes
Health Hazards (Acute and Chronic)	Cause eye & skin irritation, material is irritating to mucous membranes and upper respiratory tract. The toxicological properties have not been thoroughly investigated.		
Carcinogenicity:	NTP?	IARC Monographs?	OSHA Regulation?
Signs and Symptoms of Exposure			
Medical Conditions Generally Aggravated by Exposure			
Emergency First Aid Procedures	Swallowed - wash out mouth with water provided person is conscious. Skin/eye contact - flush with water Inhalation - remove to fresh air		
Section VII - Precautions for Safe Handling and Use			
Steps to be Taken in case Material is Released for Spilled	Wear respirator, chemical safety goggles, rubber boots and heavy rubber gloves, sweep up, place in a bag and hold for waste disposal.		
Waste Disposal Method	For small quantities - cautiously add to a large stirred excess of water. Adjust pH to neutral		
Precautions to be Taken in Handling and Storing	Wear appropriate NIOSH/MSHA approved respirator, chemical resistant gloves, safety goggles safety shower and eye bath.		
Other Precautions			
Section VIII - Control Measures			
Respiratory Protection (Specify Type) NIOSH/MSHA approved respirator			
Ventilation	Local Exhaust	N/A	Special N/A
	Mechanical (General)	N/A	Other N/A
Protective Gloves	Yes	Eye Protection	Yes
Other Protective Clothing or Equipment			
Work/Hygienic Practices	Do not ingest. Avoid contact with skin, eyes and clothing. Wash thoroughly after handling.		