

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 | |
| • 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

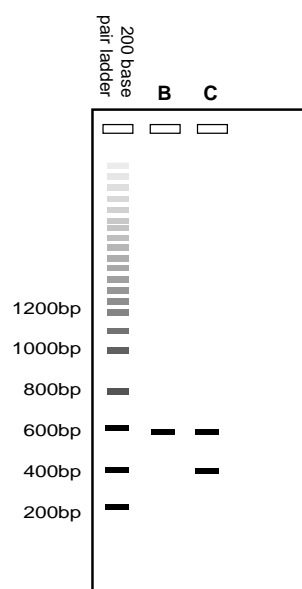
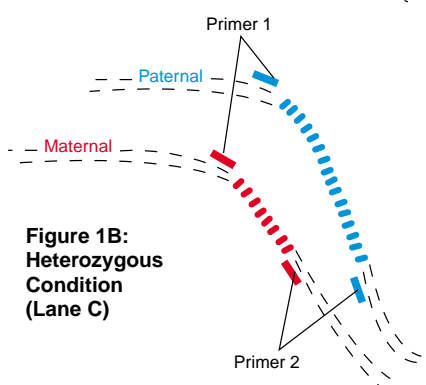
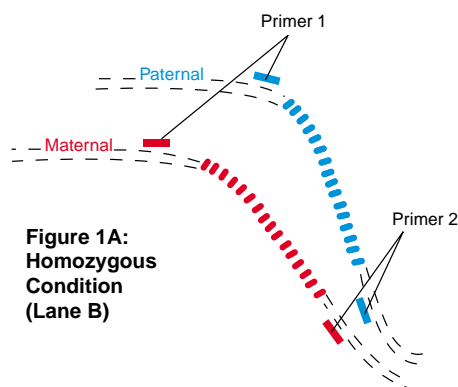


Figure 1:
PCR Amplification
Products of D1S80 Locus

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

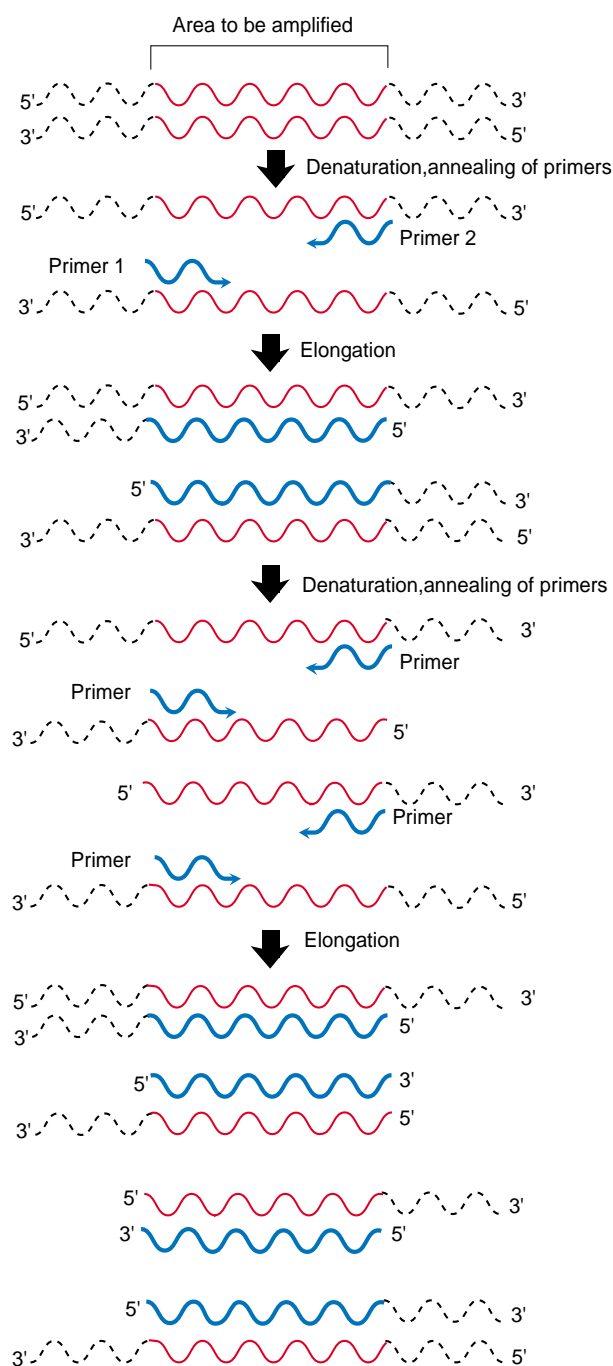
Background Information,
continued


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 | |
| 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 09-15-2002 |
| | 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 | |


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|--|--|----------------|----------------------|
| 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 | |
| Manufacturer's Name EDVOTEK, INC P.O. Box 1232 West Bethesda, MD 20827 | Emergency Telephone Number (301) 251-5990 |
| | 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 | |


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| 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. | | | |

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|  <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 | | | |


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| 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? Yes | | | |
| 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 | | | |

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|  <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 | | | |

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|--|----------------------|-----|-------------------------------------|
| 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. Address (Number, Street, City, State, Zip Code) 14676 Rothgeb Drive Rockville, MD 20850 | | | |
| Emergency Telephone Number (301) 251-5990 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)] OSHA PEL ACGIH TLV Other Limits Recommended % (Optional) Iminodiacetic Acid CAS #142-73-4 | | | |
| 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 | | | |

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|--|----------------------|----------------|---------------------|
| 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. Address (Number, Street, City, State, Zip Code) 14676 Rothgeb Drive Rockville, MD 20850 | | | |
| Emergency Telephone Number (301) 251-5990 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)] OSHA PEL ACGIH TLV Other Limits Recommended % (Optional) N/A Blend | | | |
| 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 | | | |

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|---|----------------------|----------------|---------------------|
| 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. | | | |