

# CRYPTOSPORIDIUM PARVUM

## PATHOGEN SAFETY DATA SHEET / INFECTIOUS SUBSTANCES

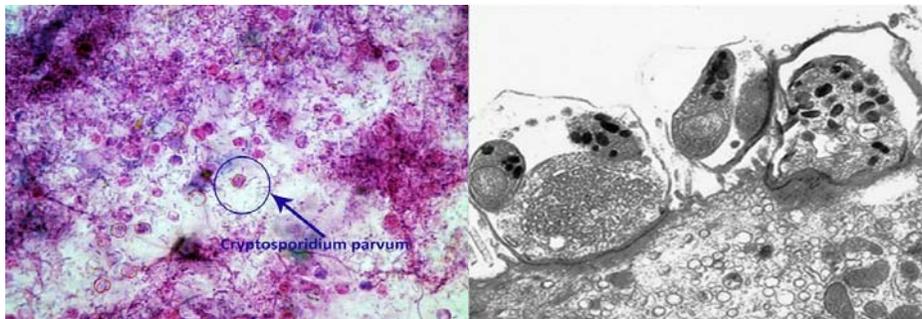
### INFECTIOUS AGENT

**NAME:** *Cryptosporidium parvum*

**SYNONYM OR CROSS REFERENCE:** Cryptosporidiosis, crypto.

**CHARACTERISTICS:** *Cryptosporidium parvum* is an intracellular protozoan parasite of the family *Cryptosporidiidae* and phylum *Apicomplexa*. It has a complex lifecycle with sexual and asexual cycles taking place in a single host. Oocysts are thick-walled and are the extracellular and environmental stage. Oocysts are 4-6  $\mu\text{m}$ , nearly spherical, which when ingested by the host, excyst within the lumen of the small intestine to release four infective sporozoites and invade surrounding cells. Sporozoites become trophozoites and subsequently type 1 meronts which reproduce asexually and release type 1 merozoites. Type 1 meronts develop into type 2 meronts and release type 2 merozoites which initiate the sexual cycle.

Coccidian protozoa; sporozoa; sexual and asexual cycles in a single host; sporozoites, trophozoites and merozoites all attach to epithelial cells (generally intestinal cells); mature oocyst contains 4 thin, flat motile sporozoites (2-4 by 6-8 $\mu\text{m}$ ).



*Cryptosporidium parvum* oocysts in a human stool smear<sup>1)</sup>

Transmission electron micrograph of *Cryptosporidium parvum* located just below the plasma membrane of the intestine of the infected host<sup>2)</sup>

### HAZARD IDENTIFICATION

**PATHOGENICITY:** Infection causes acute gastroenteritis. Symptoms include diarrhea without red blood cells, abdominal pain, cramps, fever, vomiting, myalgia, flatulence, nausea, anorexia, malaise, and fatigue. In immunocompetent individuals, illness is self-limiting with symptoms lasting for up to three weeks. Immunocompromised individuals can develop prolonged and chronic cryptosporidiosis. Cryptosporidiosis in immunocompromised patients may lead to more severe clinical manifestations such as severe weight loss, cholangitis, pancreatitis, sclerosing cholangitis, and liver cirrhosis, and has also been associated with an increased rate of morbidity and mortality. This organism is categorized as a Class B bioterrorism agent by the U.S. Department of Homeland Security.

**EPIDEMIOLOGY:** *C. parvum* occurs worldwide and is ubiquitous in the environment. Cryptosporidiosis is in the top five most common causes of infectious diarrhea around the globe. Prevalence varies based on climate and level of development, accounting for 0.1-2% of diarrheal illness in cooler and developed areas and 0.5-10% in warmer and developing countries. Settings involving close contact with infected persons, including day-care centers, which increase transmission. Outbreaks have been associated with contaminated food, drinking, and recreational water. One outbreak linked to contaminated drinking water affected over 400,000 individuals in Milwaukee, Wisconsin.

**HOST RANGE:** Humans, 152 species of mammals, fish, amphibians, reptiles, and birds.

**INFECTIOUS DOSE:** The median infectious dose in healthy adult volunteers is 132 oocysts. However, the infectious dose for humans is as low as 1-5 oocysts. Infectious dose is dependent on the immune status of the host, with immunodeficient persons being much more susceptible.

**MODE OF TRANSMISSION:** Transmitted through the fecal-oral route, direct contact with infected humans or animals, contaminated food or water and aerosols.

**INCUBATION PERIOD:** 7 to 10 days.

**COMMUNICABILITY:** Highly contagious. Human-to-human transmission is common. Oocysts can be excreted up to 50 days after cessation of diarrhea.

## DISSEMINATION

**RESERVOIR:** Environment and many mammalian species.

**ZOONOSIS:** Yes - Mainly from domestic and wild ruminants.

**VECTORS:** Flying insects can act as a mechanical vector.

## STABILITY AND VIABILITY

**DRUG SUSCEPTIBILITY:** Susceptible to nitazoxanide.

**SUSCEPTIBILITY TO DISINFECTANTS:** *C. parvum* is susceptible to high concentration (> 6%) of hydrogen peroxide and ethylene oxide, ozone. It is resistant to low concentration of hydrogen peroxide, peracetic acid, sodium hypochlorite, phenolic, quaternary ammonium compound, 2% glutaraldehyde, ortho-phthalaldehyde, and 70% ethanol.

**PHYSICAL INACTIVATION:** Inactivated by moist heat (e.g. 121°C for 18 minutes), freezing (-70°C for seconds or -20°C for 24 hours), desiccation, and UV light. Use of "absolute" 1 µm filters.

**SURVIVAL OUTSIDE HOST:** Can survive for 6 months at 20°C in the environment.

## FIRST AID / MEDICAL

**SURVEILLANCE:** Detection usually by direct microscopic observation of oocysts in stool specimens. Nucleic acid and antigen detection methods have also been developed.

**FIRST AID/TREATMENT:** Illness is generally self-limiting in immunocompetent patients. Rehydration and electrolyte therapy may be used in cases with severe diarrhea. Nitazoxanide is approved for treatment of cryptosporidiosis in children aged 1 to 10 years in the USA. It has also showed promise in immunocompromised individuals. Immunocompromised patients are often treated with paromomycin, letrazuril and azithromycin. Highly active antiretroviral therapy (HAART) is currently considered the best treatment option for life-threatening cryptosporidiosis in AIDS patients.

**IMMUNIZATION:** None

**PROPHYLAXIS:** None

## LABORATORY HAZARDS

**LABORATORY-ACQUIRED INFECTIONS:** Yes, at least 16 cases of cryptosporidiosis have been reported.

**SOURCES/SPECIMENS:** Stool, intestinal biopsy specimens from humans or animals and environmental water.

**PRIMARY HAZARDS:** Ingestion of oocysts, parenteral inoculation, contact with aerosolized droplets.

**SPECIAL HAZARDS:** Contact with naturally and experimentally infected animals.

## EXPOSURE CONTROLS AND PERSONAL PROTECTION

**RISK GROUP CLASSIFICATION:** Risk group 2.

**CONTAINMENT REQUIREMENTS:** Containment Level 2 facilities, equipment, and operational practices for work involving infectious or potentially infectious materials, animals, or cultures.

**PROTECTIVE CLOTHING:** Laboratory coat. Gloves when skin contact with infectious materials and animals is unavoidable. Eye protection must be used where there is a known or potential risk of exposure to splashes.

**OTHER PRECAUTIONS:** All procedures that may produce aerosols, or involve high concentrations or large volumes should be conducted in a biological safety cabinet (BSC). The use of needles, syringes, and other sharp objects should be strictly limited. Additional precautions should be considered with work involving animals or large scale activities.

## HANDLING AND STORAGE

**SPIILLS:** Allow aerosols to settle and, wearing protective clothing, gently cover spill with paper towels and apply an appropriate disinfectant, starting at the perimeter and working towards the center. Allow sufficient contact time before clean up.

**DISPOSAL:** Decontaminate all wastes that contain or have come in contact with the infectious organism by autoclave, chemical disinfection, gamma irradiation, or incineration before disposing.

**STORAGE:** The infectious agent should be stored in leak-proof containers that are appropriately labelled.

# REFERENCE

Pathogen Safety Data Sheet (PSDS) for *Cryptosporidium parvum* has been modified from the ones produced by the Public Health Agency of Canada as educational and informational resources for laboratory personnel working with infectious substances.

- 1) Picture from [www.studyblue.com](http://www.studyblue.com)
- 2) Picture from [www.wardsworth.org](http://www.wardsworth.org)