

# PATHOGEN SAFETY DATA SHEETS: INFECTIOUS SUBSTANCES – SERRATIA SPP.

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## PATHOGEN SAFETY DATA SHEET - INFECTIOUS SUBSTANCES

### SECTION I - INFECTIOUS AGENT

**NAME:** *Serratia* spp.

**SYNONYM OR CROSS REFERENCE:** *Serratia*, *S. marcescens* (*Serratia* pattern 1, *Serratia* biotype 1, phenon A), *S. liquefaciens*, *S. entomophila*, *S. ficaria*, *S. fonticola*, *S. glossinae*, *S. grimesii*, *S. marcescens* (*S. marcescens* ss *marcescens* and *S. marcescens* ss *sakuensis*) *S. nematodiphila*, *S. odorifera*, *S. plymuthica*, *S. proteamaculans* (*S. proteamaculans* ss *proteamaculans*, *S. proteamaculans* ss *quinovora*), *S. rubidaea*, *S. ureilytica* [Footnote1](#), [Footnote2](#).

**CHARACTERISTICS:** *Serratia* spp. are chemoorganotrophic, facultative anaerobic bacteria with low nutritional requirements, and belong to the *Enterobacteriaceae* family [Footnote3](#). They are gram negative rods, 0.9-2 µm long and 0.5-0.8 µm in diameter [Footnote2](#). They possess peritrichous flagella that allow them to swim and swarm (with differentiation), and are ubiquitous in soil, water, and plant surfaces.

Many species produce a red to pink pigment, named prodigiosin, which is easier to observe in phosphate-free medium incubated at 30°C rather than 37°C [Footnote3](#). This pigment is suspected to have antibiotic, potent immunosuppressive, proapoptotic, and anticancer properties, while its role for *Serratia* spp. is still unknown [Footnote2](#). *S. marcescens* produces a biofilm, with unique cellular and structural differentiation characteristics to those of the standard biofilms produced by *Pseudomonas aeruginosa* and *Escherichia coli*. The latter bacteria produce biofilms, which only consist of microcolonies of undifferentiated cells. *Serratia* spp. also produces β-lactamases. All of the former metabolic processes are controlled by quorum sensing. *S. marcescens* ssp. *sakuensis* is able to produce endospores, but other members of the genus are not [Footnote4](#).

## SECTION II - HAZARD IDENTIFICATION

**PATHOGENICITY/TOXICITY:** *Serratia* spp. are opportunistic pathogens and are one of the ten most common causes of bacteremia in North America [Footnote5](#). They are responsible for a variety of infections, including bacteremia, pneumonia, intravenous catheter-associated infections, osteomyelitis, endocarditis, and, rarely, endogenous and exogenous endophthalmitis [Footnote2](#), [Footnote6](#). Symptom of endophthalmitis appears rapidly after infection, and may include fever, erythema, ocular pain, periorbital swelling, and hypopyon (pus in the eyes). The mortality rate from bacteremia due to *Serratia* spp. 6 months after infection is 37% [Footnote7](#).

*Serratia* infections in neonates are frequent (11-15% in neonatal intensive care unit) and may include bloodstream infection (42%), conjunctivitis (26%), pneumonia (13%), urinary tract infection (8%), meningitis (7%), and surgical site infections [Footnote8](#). Other infections in infants are documented (otitis externa, enterocolitis and omphalitis, gastroenteritis, septic arthritis, and intraperitoneal infection/abcess), but are rare. Risk factors include birth weight, use of mechanical ventilation, and gestational age (under 37 weeks are at greater risk). The mortality rate in neonates is 44%.

**EPIDEMIOLOGY:** Worldwide distribution [Footnote3](#). Biotypes, serotypes and biogroups may be region-specific. Sporadic infections are considered endemic. Epidemics may be caused by contact with a common source by multiple patients, or by patient-to-patient contact. The intestinal tract of newborns may also be infected. *S. marcescens* non-pigmented strains are more likely to cause an infection than pigmented strains [Footnote9](#). Until recently, *Serratia* was considered to be a mostly nosocomial pathogen [Footnote7](#), [Footnote10](#). In 2007, a study in the Calgary health care region (Canada) demonstrated that 65% of infections with *Serratia* species were actually of community origin. According to the same study, 10.8 per 100,000 inhabitants are carrying the pathogen and 0.9 per 100,000/year develop bacteremia. The rate of *Serratia* isolation is higher in those over 60 years of age. In the under 60 population, the rate of isolation in men and woman are slightly different (65.9 per 100,000 in men and 36.5 per 100,000 in women). The difference in isolation is mostly observed for hospital-acquired infection. There is no seasonal or yearly variation in incidence. 92% of isolates were *Serratia marcescens*, 4% *S. liquefaciens*, 1% *S. odorifera* and 1% *S. rubidaea*. Other isolates included *S. fonticola*, *S. plymuthica*, and nonspeciated *Serratia* (2%). Bacteremia was usually caused by *S. marcescens* (88%) and *S. liquefaciens* (7%). *S. odorifera* (2%) and nonspeciated *Serratia* also have caused bacteremias. Men over 60 years of ages were most susceptible to developing bacteremia.

**HOST RANGE:** Plants and animals (including human) have been found to be hosts to the different *Serratia* spp. [Footnote3](#).

**INFECTIOUS DOSE:** Unknown.

**MODE OF TRANSMISSION:** Ingestion of contaminated foods and direct contact [Footnote3](#). Nosocomial transmission may occur by hand contact from hospital personnel and other patients. Fomites may also spread *Serratia*.

**INCUBATION PERIOD:** Unknown.

**COMMUNICABILITY:** *Serratia* may be directly transmitted from person-to-person, but rates are unknown [Footnote3](#).

## SECTION III - DISSEMINATION

**RESERVOIR:** Soil and animal (including human) are considered reservoirs [Footnote3](#).

**ZOONOSIS:** None [Footnote3](#).

**VECTORS:** None [Footnote3](#).

## SECTION IV - STABILITY AND VIABILITY

**DRUG SUSCEPTIBILITY:** *Serratia* spp. are usually susceptible to aminoglycosides, fluoroquinolones, and co-trimazole [Footnote7](#).

**DRUG RESISTANCE:** Many *Serratia* spp. isolates (39-73%) are resistant to gentamicin [Footnote7](#). They are all resistant to penicillins and cephalosporin.

**SUSCEPTIBILITY TO DISINFECTANTS:** Phenolic disinfectants, 1% sodium hypochlorite, 70% ethanol, formaldehyde, glutaraldehyde, iodophore, and peracetic acid are effective against *Serratia* spp. [Footnote11](#).

**PHYSICAL INACTIVATION:** *Serratia* spp. are inactivated by UV, microwave, gamma radiation, moist heat (121°C for at least 20 min), and dry heat (165-170°C for 2 h) [Footnote12](#)-[Footnote15](#).

**SURVIVAL OUTSIDE HOST:** *S. marcescens* may survive from 3 days to 2 month on dry, inanimate surfaces, and 5 weeks on dry floor [Footnote16](#). The organism may survive less than 4 days in a blood bag under aerobic conditions and 20 days in semi-anaerobic/anaerobic conditions [Footnote17](#). It has been also reported to survive in contact lens disinfectant (with chlorheximide), double-distilled water, non-medicated hand soap, but no duration has been reported for those cases [Footnote18](#)-[Footnote20](#).

## SECTION V – FIRST AID / MEDICAL

**SURVEILLANCE:** Monitor for symptoms and perform bacteriological isolation and serotyping/biotyping [Footnote3](#).

**FIRST AID/TREATMENT:** Give appropriate antibiotherapy [Footnote3](#).

**IMMUNIZATION:** None currently available.

**PROPHYLAXIS:** None currently available.

## SECTION VI - LABORATORY HAZARDS

**LABORATORY-ACQUIRED INFECTIONS:** 5 laboratory acquired infection with *S. marcescens* have been reported as of 1999 [Footnote11](#).

**SOURCES/SPECIMENS:** *Serratia* spp. are found in feces, wound exudates, respiratory specimen, blood, eye culture, and urine [Footnote10](#).

**PRIMARY HAZARDS:** Accidental parenteral inoculation, droplets exposure of mucous membrane, infectious aerosols, and ingestion [Footnote11](#).

**SPECIAL HAZARDS:** None.

## SECTION VII – EXPOSURE CONTROLS / PERSONAL PROTECTION

**RISK GROUP CLASSIFICATION:** Risk Group 2. This risk group applies to the genus as a whole, and may not apply to every species within the genus.

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

**PROTECTIVE CLOTHING:** Lab coat. Gloves when direct skin contact with infected materials or animals is unavoidable. Eye protection must be used where there is a known or potential risk of exposure to splashes [Footnote21](#).

**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 [Footnote21](#).

## SECTION VIII – HANDLING AND STORAGE

**SPILLS:** 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 centre. Allow sufficient contact time before clean up.

**DISPOSAL:** All material should be decontaminated before disposal with steam sterilization, incineration or chemical disinfection.

**STORAGE:** Samples and biological material should be store in appropriately labelled sealed containers.

## SECTION IX - REGULATORY AND OTHER INFORMATION

**REGULATORY INFORMATION:** The import, transport, and use of pathogens in Canada is regulated under many regulatory bodies, including the Public Health Agency of Canada, Health Canada, Canadian Food Inspection Agency, Environment Canada, and Transport Canada. Users are responsible for ensuring they are compliant with all relevant acts, regulations, guidelines, and standards.

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**PREPARED BY:** Pathogen Regulation Directorate, Public Health Agency of Canada.

Although the information, opinions and recommendations contained in this Pathogen Safety Data Sheet are compiled from sources believed to be reliable, we accept no responsibility for the accuracy, sufficiency, or reliability or for any loss or injury resulting from the use of the information. Newly discovered hazards are frequent and this information may not be completely up to date.

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**J.P. Euzéby: List of Prokaryotic names with Standing in Nomenclature - Genus Serratia**

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