



FACT SHEET

Ricin

1. General [1, 2]

Ricin is a plant poison. The seeds of *Ricinus communis* (also known as the castor bean plant, see Fig. 1+2) from the Euphorbiaceae family contain about 1-2% ricin. The poison provides the plant with natural protection from insect pests. This subtropical to tropical plant is predominantly cultivated on a large scale in India, Brazil and China for the production of castor oil. It is frequently found as a magnificent ornamental plant in the garden.



Fig. 1: Blossoming castor bean bush



Fig. 2: Seed kernels of *Ricinus communis*

2. Bioweapon potential

Ricin is a glycoprotein and as such its chemical stability is rather low. Non-physiological conditions like heat, UV radiation, high/low pH values and oxidizing chemicals quickly render the toxin inactive. It is technically very difficult to deliver ricin as an aerosol, which is why, from a military perspective, it is rated lower than classic biological and chemical warfare agents, even though it is specified in List 1 (banned materials) of the Chemical Weapons' Convention.

However, the risk of ricin being selectively deployed as a weapon of terror should not be underestimated. The industrial manufacture of castor oil produces a bean mash from which the ricin can be readily extracted. Given this ready availability, terrorists could then spike the food chain with the ricin toxin.

3. Chemical structure and properties [3]

Ricin is a glycoprotein which inhibits intracellular protein synthesis through ribosomal inactivation. It is thought that because of its enzymatic property a single ricin molecule can translocate to the cytosol and thus kill cells.

It has a molecular weight of around 64 kDa (approx. 570 amino acids) and is composed of two structural sub-units, the A and B chains, which are connected by an intermolecular disulphide bond (see Fig. 3). The B chain has two binding sites where specific glycans latch on to the cell surface (lectin) and stimulate endocytosis in the cytosol of the target cells. The A chain is an enzyme (RNA-N-glycosidase) that inactivates the ribosomes of the endoplasmic reticulum by removing adenine.



Fig. 3: Structure of ricin
 A chain = sky blue
 B chain = orange

4. Toxicity [4, 5]

The toxicity of ricin greatly depends on the route of exposure. For example, oral exposure is much less toxic than inhalation or injection exposure.

LD₅₀ in mice:

Oral	=	20 – 30 mg/kg
Injection	=	0.05 – 0.1 mg/kg
Inhalation	=	0.03 – 0.05 mg/kg (particle < 5 µm)

However, there are several reasons why data extrapolated from animal tests to humans should be interpreted with great caution. According to the literature, the oral toxicity of ricin in humans varies from 0.003 to 20 mg/kg.

5. Analytical methods [6]

The SPIEZ LABORATORY deploys the following tests to detect ricin:

- Immunoassays (LFA, ELISA and Luminex Technology)
- Mass spectrometry (MALDI-TOF MS and LC-MS/MS)
- Bioassay (measurement of cytotoxicity in Vero cells)

6. Literature/information

- [1] <http://en.wikipedia.org/wiki/Ricin>
- [2] http://www.awl.ch/heilpflanzen/ricinus_communis/index.htm
- [3] Ricin. Olsnes S., Kozlov J.V., *Toxicon* 39 (2001) pp. 1723-1728
- [4] Ricin Poisoning – A Comprehensive Review.
 Audi J, Belson M, Patel M, Schier J, Osterloh J. *JAMA*. 2005 Nov 9;294(18):2342-51.
- [5] Ricin as a weapon of mass terror--separating fact from fiction.
 Schep LJ, Temple WA, Butt GA, Beasley MD. *Environ Int*. 2009 Nov;35(8):1267-71.
 Epub 2009 Sep 19. Review.
- [6] http://www.bt.cdc.gov/agent/ricin/pdf/ricin_protocol.pdf

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