University of Colorado
Denver | Anschutz Medical Campus

IACUC
Institutional Animal Care and Use Committee

Subject:	**Policy on Administration of Dimethyl Sulfoxide (DMSO) in Rodents**
Source:	Institutional Animal Care and Use Committee
Effective Date:	2/10/2025
Replaces	
Applies To:	Personnel involved in research or teaching studies involving animals
Reference	Animal Welfare Act; PHS Policy on Humane Care & Use of Laboratory Animals; Guide for the Care & Use of Laboratory Animals

Dimethyl Sulfoxide (DMSO) is a commonly used and useful solvent for experimental agents that are not water soluble. The following guidelines were created for DMSO use in rodents but can be used to advise dosing in different species. Adverse health effects from administration of DMSO occur based on 2 different, but related parameters.

1. The concentration (%) DMSO in an injected solution
2. The dose or total amount administered (mL/kg or g/kg), independent of dilution

Campus Guidelines

1. **Concentration**: The DMSO concentration should not exceed 20% (v/v) when prepared for oral gavage , IV or IP injection.[5,8]
2. **Dose**: A DMSO dose should not exceed 2 mL/kg or 2.2 g/kg of body weight when administered by oral gavage, IV or IP injection.[1,2,4,7] For example, the maximum allowable dose administered to a 25 g mouse should not be greater than 0.05 mL (2 mL/kg x 0.025 kg) or 55 g (2.2 g/kg x 0.025 kg).
3. **Neonatal Concentration and Dose**: The concentration and dose limits above also apply to neonatal mice and rats. However, neuronal toxicity in neonates has been documented at doses much lower than above but with no indications of morbidity or mortality.[3,6]
4. **Serial Administration**: The concentration and dose listed above are considered the maximums to be administered within 24 hr.
5. **Documentation**: In the IACUC protocol, list both the concentration (%) and the dose (mL/kg or g/kg) of the administered solution.
6. **Exceeding Recommendations**: Higher DMSO concentrations, doses, with an increased frequency of administration will be considered by the IACUC on a case by case basis. Scientific justification and no demonstrated or prospective adverse health effects will be required to support such a request.

DMSO Chemical Properties

- Density = 1.1 g/mL
- Molecular Weight = 78.13 g/moL = 78.13 Daltons
- Molarity = 14.1 Molar (M)

Example Calculations

1. The research team wants to perform an IP injection of a 0.5 mL solution consisting of 20% DMSO into a 25 gram mouse every 24 hr for 3 days. Is this ok?

- Answer: No.
- 20% of a 0.5 mL solution = 0.1 mL of DMSO
- 0.1 mL DMSO x 1.1 g/mL (density) = 0.11 g DMSO
- 0.11 g DMSO / 0.025 kg (mouse weight) = 4.4 g/kg = 4 mL/kg DMSO
- Rationale: Despite the % concentration, frequency and route of injection being appropriate, the dose of 4.4 g/kg is 2 times above the maximum dose allowable of DMSO on the CU Anschutz Medical Campus.

2. The research team makes an initial 20 mL solution of Dasatinib where the vehicle contains 4% DMSO + 30% PEG400 + 5% Tween80 + 12.2 mL of sterile H_2O. The volume given per 25 gram mouse is 0.1 mL, PO daily for 5 days. Is this ok?
   - Answer: Yes.
   - If the initial 20 mL solution is 4% DMSO, the 0.1 mL administered is also 4%.
   - 4% of a 0.1 mL solution = 0.004 mL of DMSO
   - 0.004 mL DMSO x 1.1 g/mL (density) = 0.0044 g DMSO
   - 0.0044 g DMSO / 0.025 kg (mouse weight) = 0.176 g/kg = 0.16 mL/kg DMSO
   - Rationale: The dose, % concentration, frequency and route of DMSO administration in the Dasatinib solution are all appropriate and fall well below the limit of DMSO on the CU Anschutz Medical Campus.

References

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3. **Hanslick JL, Lau K, Noguchi KK, Olney JW, Zorumski CF, Mennerick S, Farber NB**. 2009. Dimethyl sulfoxide (DMSO) produces widespread apoptosis in the developing central nervous system. *Neurobiol Dis* 34:1-10.
4. **Kramer K, van Acker S, Grimbergen J, van den Berg D-J, Vijgh W, Bast A**. 1995. Effect of dimethyl sulfoxide (DMSO) on the electrocardiogram (ECG) in freely moving male Balb/c mice. *General Pharmacology: The Vascular System* 26:1403-1407.
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6. **Rabow Z, Morningstar T, Showalter M, Heil H, Thongphanh K, Fan S, Chan J, Martínez-Cerdeño V, Berman R, Zagzag D, Nudler E, Fiehn O, Lechpammer M**. 2021. Exposure to DMSO during infancy alters neurochemistry, social interactions, and brain morphology in long-evans rats. *Brain Behav* 11:e02146.
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Per regulatory requirements, failure to comply with this policy may result in notification of your funding agency (e.g. NIH) and regulatory agencies (e.g. USDA) that your research has violated federal and/or local policies regarding the humane use of animals. This notification may affect continuous funding of your animal-related research. Further, depending on the violation, you may be required to take additional training and/or your privilege to conduct animal research at CU Denver | Anschutz might be temporarily suspended or even completely revoked.