



## BDG SYNTHESIS

### Certificate of Analysis

This material is a research-grade material prepared by custom synthesis. The quantity available is limited, and this limits the extent and type of analytical data which can be obtained. This Certificate is presented in descriptive format for use by analytical chemists who are trained in the use of research-grade materials. Research materials often contain higher levels of residual solvents and/or water, and we urge you to use the corrected purity where needed rather than the raw HPLC purity.

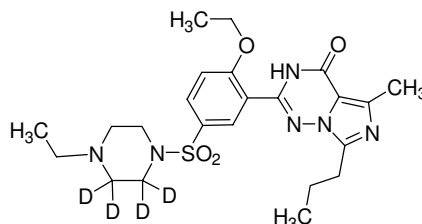
BDG Synthesis certifies that this reference material meets or exceeds the specifications stated in this data sheet.

*Barry Dent*

Barry R. Dent PhD, Director  
17 November 2006

**Name:** Vardenafil-d<sub>4</sub>  
**CAS Number:** none (224785-90-4 unlabelled)

**Structure:**



**Molecular Weight:**  $C_{23}H_{28}D_4N_6O_4S = 492.64$   
**Lot Number:** BDG 6615.1  
**Appearance:** Off-white, crystalline solid  
**Corrected Purity:** 96.8 % (HPLC) – 0.7 % (water) = 96.1 %  
**Isotopic Purity:** Under 0.5 % d<sub>0</sub>  
**Expiry Date:** 17 November 2011

This expiry date is assigned from experience gained with the material in the laboratory and/or on storage. It is not possible to perform formal storage stability studies because of the small amount of material available.

**Storage and Handling:**

Temperature: ambient laboratory temperature; may be refrigerated.  
Humidity: not believed to be hygroscopic; may be handled in normal laboratory atmosphere.  
Light: store in an amber vial and protect from bright light.  
Caution: Only experienced laboratory personnel should handle the material.

## Identity and Purity:

### Source of Material

The material was made by an unambiguous synthetic route, using literature procedures where possible; starting materials were purchased from reputable sources and all intermediates were checked for identity by NMR.

### Proton NMR Spectrum

Identity: the signals are consistent with the proposed structure and in accord with literature where available.

Isotopic labelling: signals at the sites of deuteration are greatly diminished, compared with what would be expected for unlabelled material, indicating clean deuteration.

Residual solvents: no residual solvents are observed.

Impurities: traces of unidentified impurities are seen in the baseline.

### Carbon-13 NMR Spectrum

Identity: the signals are consistent with the proposed structure and in accord with literature where available.

Isotopic labelling: signals at the sites of deuteration have collapsed to small multiplets compared with what would be expected for unlabelled material, indicating clean deuteration.

**High-resolution mass spectrum (ESI+):** found  $m/z$  247.1316,  $z = 2$  ( $m/z$  494.2633).  $C_{23}H_{30}D_4N_6O_4S$   $[M+2H]^{2+}$  requires  $m/z$  494.2613. The deviation of 4.8 ppm is within normally accepted limits for the establishment of identity by HRMS. No signal for  $d_0$  material was seen (detection limit about 0.5 %).

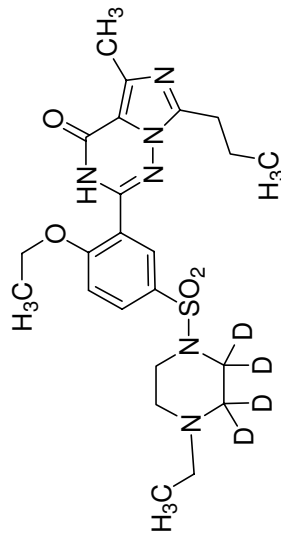
**HPLC:** A somewhat broadened, slightly tailing peak is observed (96.8 area %). Note: in the absence of reference materials for preparing calibration curves, it is assumed that all peaks have the same detector response. Where possible, the conditions of analysis follow a pharmacopeial or literature method, or have been adapted from same.

<b>Elemental Analysis:</b>	Found:	C 55.64, H 5.67, D 1.63, N 17.11 %
$C_{23}H_{28}D_4N_6O_4S \cdot 0.2H_2O$	requires:	C 55.66, H 5.77, D 1.62, N 16.94 %, $H_2O$ 0.7 %
$C_{23}H_{28}D_4N_6O_4S$	requires:	C 56.08, H 5.73, D 1.64, N 17.07 %

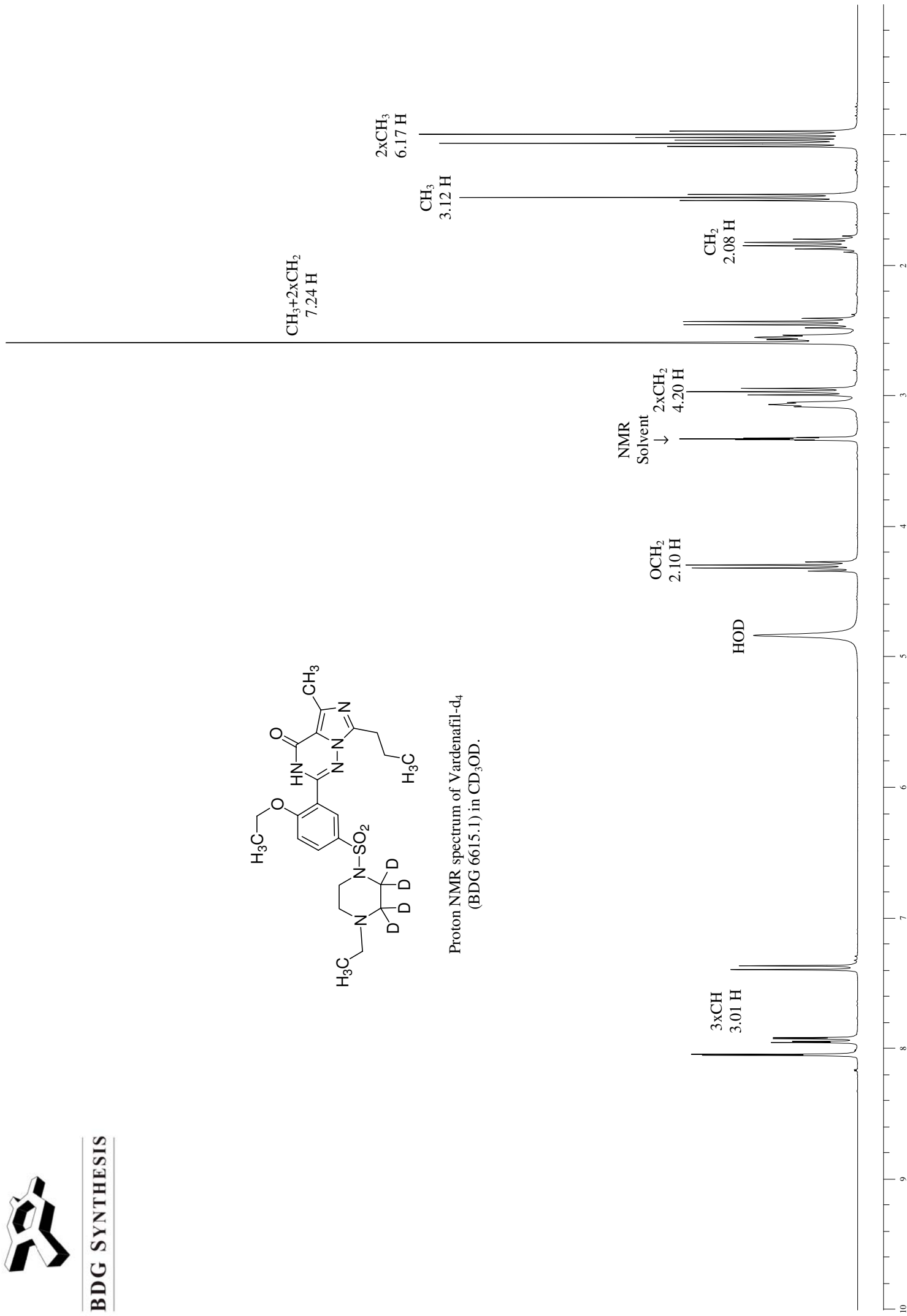
The elemental analyses fall slightly outside those expected for anhydrous material; the presence of water is reasonably expected from the method of purification and/or the type of material, and the "best-fit" hydrated molecular formula is given. In the absence of a Karl-Fischer water analysis, we recommend that the "best-fit" water content be used when determining corrected purity.



# BDG SYNTHESIS

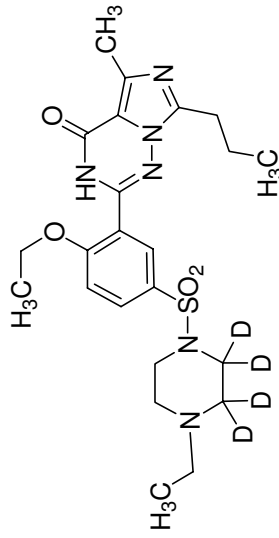


Proton NMR spectrum of Vardenafil-d<sub>4</sub>  
(BDG 6615.1) in CD<sub>3</sub>OD.



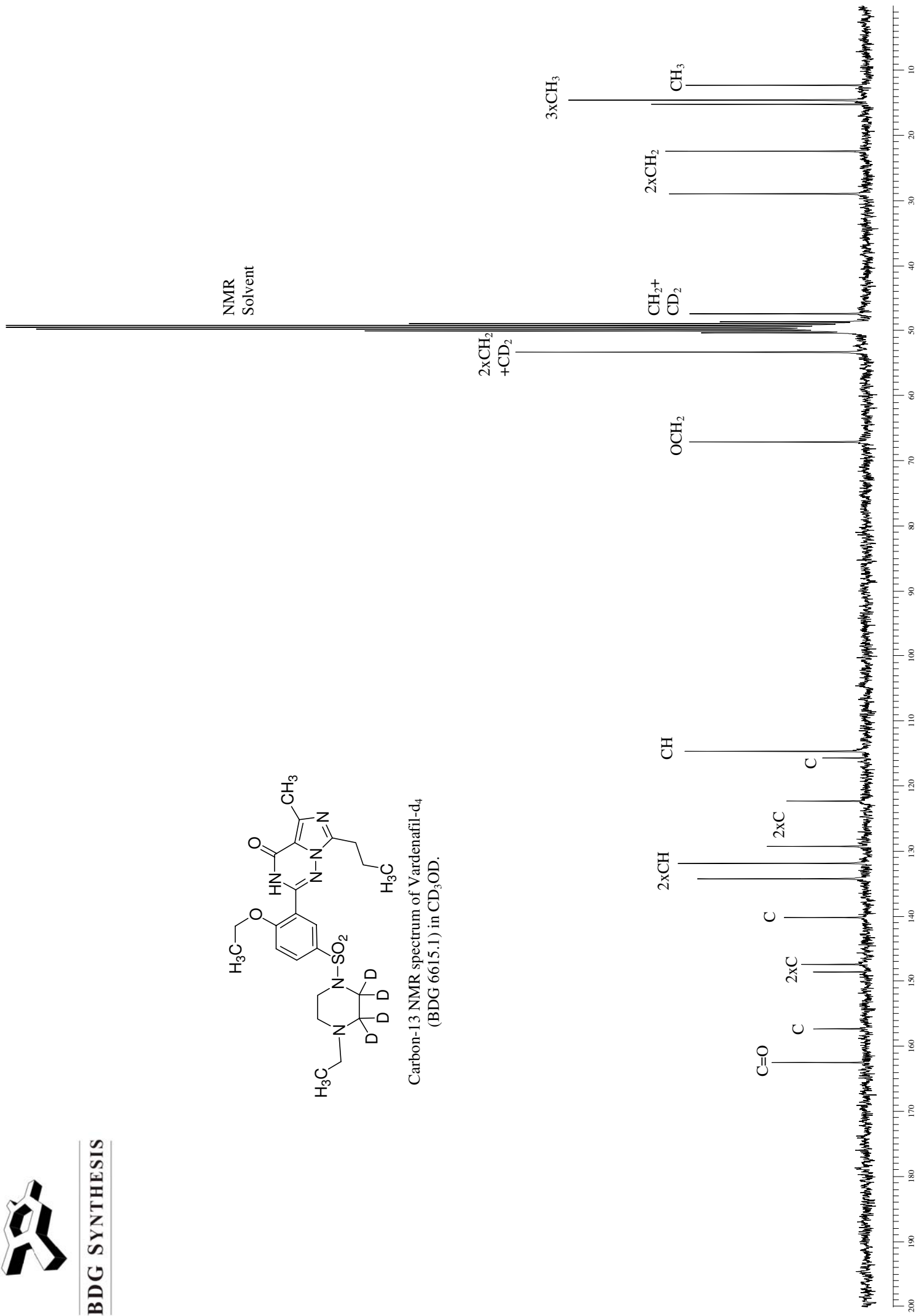


## BDG SYNTHESIS



Carbon-13 NMR spectrum of Vardenafil-d<sub>4</sub>  
(BDG 6615.1) in CD<sub>3</sub>OD.

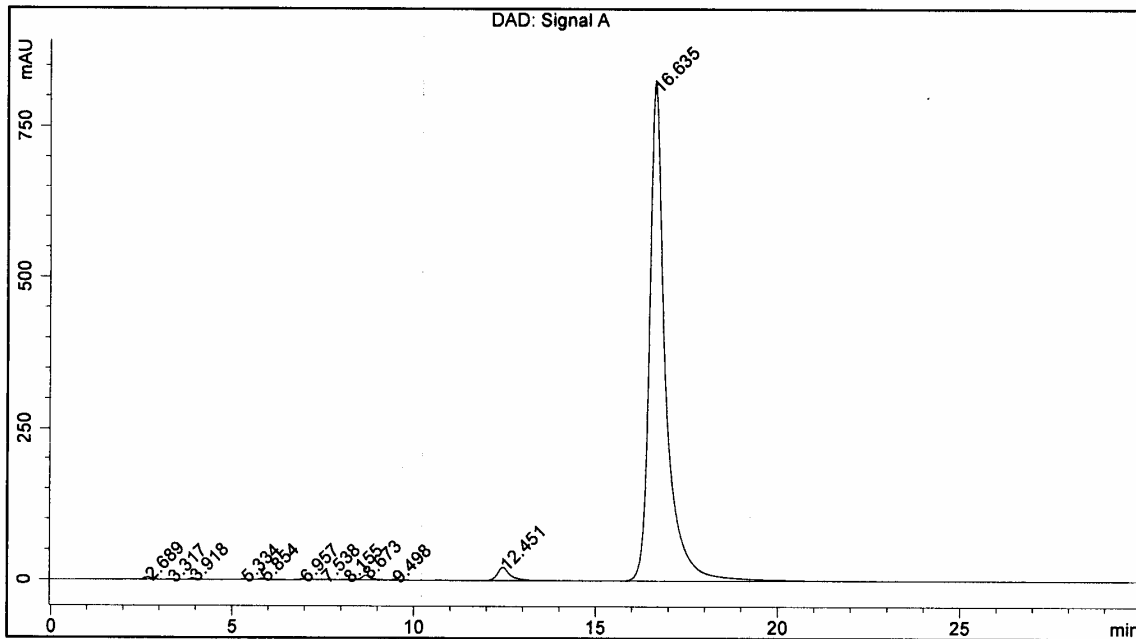
NMR  
Solvent



BDG - Analysis of Vardenafil-d4

Column : Phenomenex Luna C18(2) 5um 250 x 4.6 mm  
 Guard : Phenomenex Security Guard C18 RP 4 x 3 mm  
 Mobile Phase : 60:40 0.2M Ammonium Acetate : Acetonitrile  
 Flow Rate : 1.0 mL/min  
 Sample Solvent : Mobile Phase  
 Column Temperature : 20C  
 Injection Volume : 10 uL  
 Detection : UV at 240 nm

<b>Sample Name</b>	BDG 6615.1	<b>Instrument</b>	AnalyticalLC01
<b>Acquisition</b>	11/11/2006, 13:11:47	<b>Method (rev.)</b>	LC10062a ( 3 )
<b>Sequence</b>	BDG_11Nov2006a	<b>Vial Position</b>	1
<b>Operator</b>	solvation010\cerityadmin	<b>Injection</b>	2 of 2



Area Percent Report

Peak#	RT	Peak Height	Peak Area	Width	Area %
1	2.69 min	4.0367	47.5916	0.1615 min	0.182 %
2	3.32 min	0.5266	4.9888	0.1345 min	0.019 %
3	3.92 min	2.3557	21.5404	0.1327 min	0.082 %
4	5.33 min	0.7097	8.5190	0.1860 min	0.032 %
5	5.85 min	2.1647	29.2402	0.1936 min	0.112 %
6	6.96 min	1.2360	15.2322	0.1798 min	0.058 %
7	7.54 min	0.9864	12.5623	0.1966 min	0.048 %
8	8.16 min	0.6051	10.5935	0.2542 min	0.040 %
9	8.67 min	7.2922	135.7333	0.2652 min	0.518 %
10	9.50 min	0.7890	13.7349	0.2551 min	0.052 %
11	12.45 min	21.6793	547.5026	0.3646 min	2.088 %
12	16.63 min	823.0092	25370.4305	0.4416 min	96.768 %